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The Iowa Convention.

Among the more important features of the Iowa Electrical Association convention, held last week, were the papers and discussions on ice-making, electric heating and analysis of costs. The report on the manufacture of ice as an adjunct to the central station business as given by Mr. Rufus Lee is decidedly encouraging to central station companies which have been contemplating the establishment of ice plants as auxiliaries. The ice plant as operated by the small central station has considerable advantage over an independent ice plant or an independent central station in the matter of interest on idle investment and wages of employees. The small central station maintaining as it does an operating force large enough for both winter and summer, is not under the expense for engineers and firemen that an independent ice plant would be. Furthermore, the boiler plant sufficient to carry the winter peak lighting load is sufficient to carry both ice-making and lighting loads during the summer. When one considers large central stations and large ice plants, the situation is entirely different, except as regards boiler capacity. Iowa has a large number of central stations of a size suited to running auxiliary ice plants to advantage. Of course, if the central station can get other people to establish ice and refrigerating plants in a town and sell them energy, so much the better.

Another subject to which considerable attention was rightly given was electric heating and cooking. This is a development which should appeal strongly to many Iowa stations for the reason that Iowa is essentially an agricultural rather than a manufacturing State, although there is a constantly increasing amount of small manufacturing. This fact limits the possible motor load in most of the small towns, and the wide-awake manager is casting about for other means of increasing his day load after having developed the motor load to a point where it cannot be increased very much. The electric flatiron and the train of other heating and cooking appliances which follow it are the most generally applicable means of securing such a day load. There are so many towns of a size sufficient to operate a day circuit but too small for a gas plant, that electric heating devices, if properly pushed, will mean a great deal to the industry. Even where there is a gas plant, electric heating, if the rates are right, would seem to have nearly as good a show against its seemingly cheaper competitor as electric light has against its seemingly cheaper competitor. When all the facts are known, some of these apparently cheap things do not seem so cheap; and there is constantly too much of a tendency on the part of central station men to look at the cost of electric cooking and let that blind them to everything else in its favor. Another encouraging thing at the Iowa convention was the report by Prof. L. B. Spinney, and the discussion on costs and the necessity for uniform systems of classifying accounts. The report on costs of operation, while not containing figures from

nearly as many companies as it should, nevertheless represents an encouraging beginning, and it shows that a few companies at least are willing to compare notes, and that in time uniform acccounting and comparing of cost factors may become general.

The New Engineering Societies Building.

The opening of the new Engineering Societies Building has attracted widespread attention both in this country and abroad. It stands for and embodies an idea which was evidently in the mind of Mr. Carnegie, the donor of the building, namely, that all engineers, whether engaged in mechanical work, mining work, or electrical work, are essentially one and the same group of men from an intellectual standpoint, actuated by essentially the same impulses and directing their activities to essentially the same end—the subjugation of the immediately surrounding material universe to the will of mankind. As Mr. Carnegie himself expressed the idea in the course of his address at the opening ceremonies, an engineer is a man to whom two and two make four and one more five, constantly and unfailingly, who works steadfastly day by day to a fixed goal, with the eternal truth of nature in his mind. All engineers use the same fundamental arithmetic and the same fundamental laws of mechanics and physics applied to the affairs of industry and commerce. It is because of this similarity of mental training, and the similarity of mental habit developed by experience under this training, that they are intellectually of the same type, whether their work is underground in mines, or on board large steamers, or in factories or on railroads.

It is essentially the similarity of intellectual habit and of psychological processes that fits and molds men to work together and cooperate. The salient idea presented and maintained by the new Engineering Societies Building is that in spite of the continued differentiation of engineering and of engineers into new activities and duties, there is also an amalgamation going on to offset the centrifugal tendency. In the matters of art, politics and religion, the continued differentiation which goes on is essentially diffusion, schism and division, whereby men tend to separate and segregate. In applied science, however, the differentiation is merely a process of economical subdivision for the better performance of different tasks, and does not involve disputation or opposition. The situation of the new building is particularly fortunate for the majority of the members. It is close to the new termini of the railroads crossing the Hudson River on the one hand and to the Grand Central terminus on the other. Moreover, it is close to the new library of the City of New York. A more centrally disposed site in New York could hardly have been chosen. The joint library of the three component societies ought to constitute the best engineering library in America and the opportunities offered for study there should be unique. With the allied beautiful and comfortable Engineers' Club which opens this week, it is an invaluable addition to the technical and social resources of engineering in America.

Studies in Photometry.

We abstract in the Digest this week an important paper by M. Lauriol, which is the sequel of a discussion in the columns of *L'Industrie Electrique* opened by the late Prof. Hospitalier and M. Laporte. The questions at first raised were those of color photometry, broadened by M. Lauriol into a general consideration of the conditions of sufficiency in photometric measures. To give a brief résumé of the discussion, M. Hospitalier's text was found in a paper by Bastian touching the photometry of his mercury lamp. The particular feature emphasized was the variation in results obtained in comparisons with the source at varying distances. M. Laporte in a most lucid and suggestive note called attention to the need of photometry under clearly defined conditions and with a working illumination somewhere near the values customarily used in artificial lighting. Incidentally he noted the considerable variation in the readings of even a Lummer-Brodhun contrast screen resulting from stopping down the eye itself when comparing colored lights. M. Lauriol in the paper in hand calls particular attention to the probability that in practical color photometry, first, the ratio of the measures of two quantities is not independent of the unit by which they are measured; and second, that even in general the valuation of the whole is not equal to the sum of its parts.

Now granting that color photometry is in a sorry parlous state, the melancholy views here presented seem to us somewhat overdrawn. Photometry even in case of nearly similar lights cannot rank as a measurement of precision in the sense of measurements of length or mass. Yet there is good reason to believe from recent work in the Bureau of Standards that an incandescent lamp standardized in a number of laboratories by different observers using different methods will furnish results concordant far within one per cent. Could equal precision be obtained in color photometry there would be little cause for complaint. There are, however, special difficulties which intervene to prevent so agreeable an issue. Foremost is Purkinje's phenomenon, which is the source of great variations with the intensity of illumination. Second comes the variation of color field in the eye itself, considerably mixed up with Purkinje's effect and causing notable variations with the area of field observed, and with the intensity as well, since the relative areas of the several color fields change with the degree of stimulation. Third, perhaps, comes the absorption of the yellow spot, superimposed upon the two first effects and varying from observer to observer. And finally there is the broad general fact that for equal luminous energy the luminous effect varies enormously with the wave length, the relative luminosities themselves varying somewhat from eye to eye and in the same eye at different ages, owing to increasing absorption in the yellow spot.

The summation of these several factors changes with the photometric method employed. In any attempt at scientific color photometry the method should be so chosen as to minimize the influence of these variables. The screen advised by M. Lauriol is practically that of Ritchie, being a right isosceles prism with a diffusing surface, its apex being in the line of sight and its base in the line of the photometer bar. It certainly has the advantage of extreme simplicity, and we think most observers would find it easier to use on colored lights than the Lummer-Brodhun screen. Yet it is subject to certain sources of error which would appear to have led M. Lauriol into difficulties when measuring group sources at different distances along the bar. The trouble is this, that the light reflected diffusely from the prism face depends upon the angle of incidence and is unsymmetrical with respect to this angle. Hence in using a group source from which the incident rays are not parallel, there will be an error introduced varying with the distance of the group from the screen. This difficulty holds in greater or less degree

for all photometers with diffusing screens, and would be especially troublesome in measuring rather large sources. Perhaps such cases are best dealt with by keeping the source at such a fixed distance from the screen as to make the rays sensibly parallel with respect to possible variations of the coefficient of diffuse reflection and to obtain balance by moving the reference light. This is inconvenient on account of the construction of many photometers, but provision should be made for it. In comparing lights which differ greatly in color we do not believe that any screen yet devised will give reliable results, although they may be fairly consistent. In such cases the spectro-photometer or some modification of Crova's method is far more likely to answer the purpose. Fortunately the problem is somewhat simplified, as M. Lauriol suggests, by the fact that one seldom has to deal with extreme color differences. Yet those now met in commercial practice are great enough to cause serious errors with the forms of photometer now in general use. The subject is one that should receive immediate attention, and the thing of direct and practical importance is to secure agreement on a set of standard conditions for color photometry even if frankly empirical ones.

Colorado Springs Decision.

The award of the Board of Arbitration in the Colorado Springs arc lighting case, printed elsewhere in this issue, is one that can profitably be studied by all those interested in municipal lighting contracts. It is the more important since under the statistics of Colorado such a Board has practically the dignity and authority of a Court and its findings carry the weight of a judicial precedent. The decision was reached after long deliberation and the analysis of a very large amount of expert evidence. The chief point at issue was the definition of an "arc lamp of standard 2000 candle-power" as of the year 1898, and the relation of such lamp to that actually provided by the operating company. There are probably few contracts of so early date still in force without formal modification, but the same issue probably exists in a few scattered instances. In the matter of definition the decision and the evidence are clear that the direct current series open arc of about 9.6 amperes and 450 watts at the arc, was at the date named the thing generally accepted as meeting the specification of the franchise in this case. The lamp actually furnished by the operating company was the 6.6 ampere series alternating arc taking normally 450 watts at the lamp terminals and there seems to have been entire unanimity among the Arbitrators and all the experts that this lamp did not meet the definition in fact, and fell short of giving equivalent service. Data introduced at the hearing indicated that the maximum cp of the open "pull arc" is only about 1200 instead of 2000 as popularly believed, its mean spherical cp being 400 to 450, or about 1 cp per watt, while the usual 6.6 ampere enclosed arc gives only about 150 mean spherical cp. corresponding to 3 watts per cp.

The assessment of damages for this deficit involved a good many complicated technical points. In particular the alternating lamps were in the latter part of 1906 pushed up to 450 watts or more, the voltage being raised at first and subsequently the amperes being also raised to 7 or 7.1. Thus during this period the lamps were operated materially above their normal rating and therefore came nearer to the specification. Their performance appears from the award to have been determined by taking the mean watts applied to the lamps and reducing this figure to candle-power on the basis of tests made by Prof. C. P. Matthews with the integrating photometer on lamps actually taken from the city circuits and measured for candle-power at various inputs. Considering the difficulties of arc photometry this was probably the fairest method that could have been selected. It was certainly vastly preferable to any photometric tests on the lamps *in situ*, which all the experts agreed in condemning. The findings of the Board did not state the ratio in candle-power between the lamp of the specification and the alternating current arcs as actually operated, but awarded damages to the city on the basis of a 20 per cent deficit subsequent to June 1, 1906. The earlier period of service, from February 15, 1905, was placed on a different basis, by reason of the fact that the city assumed some responsibility in the matter by tacitly permitting service without protest for a considerable period. The responsibility was assumed by the Board to have been divided with the operating company and the damages for this period were therefore halved. This portion of the award was in the nature of a compromise and therefore has but small technical bearing. No judgment was rendered on future service under the franchise, this question not having been specifically within the terms of the agreement of arbitration under which the Board was constituted. The total award to the city amounted to a little over $7.000.

This decision should go far toward settling the much mooted question of the rating of the 6.6-ampere alternating-current series arc as a street illuminant. This arc has been and still is, rated variously in nominal candle-power. It sometimes has been called 1200 cp, and sometimes 2000 cp has been substituted for both "half arcs" and "full arcs" of the older type, and more commonly has not been rated in candle-power at all, but sold for just what it is. The decision in hand implies that even at 450 watts at the terminals the alternating-current lamp fails of being a "full arc" by something like 20 per cent. This corresponds in a general way with the quite common impression among station men that if alternating current arcs are to be substituted on even terms for the old "full arcs," the 7.5 ampere alternating-current lamp should be used to retain anything like equivalent lighting. In point of fact, the 6.6-ampere lamp is a good and useful one, but should generally be spaced closer than the more powerful alternating-current arcs. Questions of equivalency in street lighting are very puzzling and will become more so as the luminous arcs begin to come into general use. So long as all arcs were of similar kind, one could get a fair idea of their relation by the watts consumed; but the open arc, the enclosed arc, alternating-current and direct-current, the flaming arc and the magnetite arc, vary so widely in both true luminous efficiency and distribution of light that a watt rating is utterly fallacious. Even the mean lower hemispherical rating adopted by the German engineers is unsatisfactory on account of differences of distribution, which must surely be given some weight. The issue in the Colorado Springs case was an anachronism, but similar issues in a very aggravated form are more than likely to arise in the next few years, and one must be on the watch for them. It may be that illumination as such can be made the subject of contracts, yet this basis is dangerous as favoring small units to a degree unwarranted by their failure to produce a high average illumination when spaced as they have been in the past.

Founders' Day at the Engineering Societies Building.

In these pages last week was given an account of the exercises in connection with the dedication of the new Engineering Societies Building, April 16, with a brief reference to the following exercises on "Founder Societies Day," April 17. In many respects the features of the dedication exercises on the second day were fully equal in interest to those of the first day, and of a more varied and popular nature, as will be appreciated from the outline of the exercises given below.

The proceedings in the main auditorium on the afternoon of April 17, were presided over by Mr. John W. Lieb, Jr., chairman of the Dedication Committee, who said:

In the dedication exercises of yesterday we gave expression to the deep gratitude of the Engineering Profession to Andrew Carnegie for his splendid gift; and our honored guests, distinguished visitors, and fellow society members have enjoyed the opportunity of inspecting the building and its equipment and of observing how completely Architect and Building Committee, in harmonious cooperation, have succeeded in the difficult task of meeting the unusual requirements and for which there existed no precedent.

The simple, plain language in which the gift was conveyed: "It will give me great pleasure to devote say one million and a half dollars to erect a Union Building for you all," and which will be preserved to history on the bronze memorial tablets opposite the entrance—was altogether unique in the history of similar great benefactions, and while they reflected the broad and liberal spirit of the donor they also placed upon the recipients the full responsibility of building wisely and administering efficiently.

We meet to-day under the auspices of the "Founder Societies," the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and the American Institute of Mining Engineers, to receive the greetings and felicitations from foreign and national engineering societies and institutions of learning and for the interchange of congratulations between the members of the Founder Societies and Associate Societies, on the successful completion of this magnificent building.

On behalf of the Founder Societies I beg to extend to the distinguished representatives of sister societies and of the institutions of learning who honor the occasion with their presence our most hearty thanks for the interest they have shown by taking part in our dedication exercises and we bid them thrice welcome. It is with particular pleasure that we extend our warmest greetings to the eminent representatives of sister societies from abroad; to them we extend the hand of professional fellowship and we ask them to share with us in the joys of these festivities.

Engineers have ever been leaders in promoting international friendships and by their International Congresses and the interchange of visits between foreign societies they have established the most enduring cordiality of relations between large bodies of influential men separated by national boundaries but having common professional ideals and the same spirit of enlightened progress. We may in fact at this time rightly consider ourselves a kind of auxiliary to the great International Peace Congress which is now holding its sessions in this city.

The engineering societies are now enjoying through the generosity of Andrew Carnegie and the cooperation of the members and friends of the societies the realization of the fond hopes which they have cherished for years, and with the opening of this building there opens also a new era for the engineering profession of this country.

The magnificent facilities which the societies have now at their disposal should go far toward making cooperation among the various branches of the engineering profession more effective, securing to the engineer that high standing in the community to which his accomplishments—literal and constructive—justly entitle him.

We hope that to our guests and friends as well as to the membership of our engineering societies these spacious halls and pleasant meeting rooms may be a new source of inspiration, awakening a greater pride in the profession we have chosen and dedicating ourselves anew to the pursuit of the highest professional ideals, to the increase of human knowledge and to the advancement of civilization.

Dr. Samuel Sheldon, president of the American Institute of Electrical Engineers, in his address said: "The Founder Societies at the present time have a total membership of about 12,000. Of these nearly 16 per cent live in New York City, or in its immediate vicinity, and to them this building is accessible. Other associated societies, with an approximate membership of 4,000, are also at home here, nearly 40 per cent of whom dwell in this vicinity. An inspection of the curves of growth of membership in the three Founder Societies shows that the enrolment will be doubled by 1920, if past policies of management be maintained. Even times of financial depression do not lessen the membership, but lessen its rate of growth. But the short period of joint occupancy just elapsed has evidenced a stimulation to increased activity which if maintained will make membership more desirable, and a greater increment may be expected.

"During the past few years there has been a rapid growth in civilization; commerce, traffic, manufactures, organization, fortunes, knowledge, and individual efficiencies have increased. Excessive and extraordinary growth has resulted from the efforts of electrical engineers. Doubtless this is due to the youth of the profession, whose oldest workers are not thinking of retirement, but, on the contrary, are enthusiastically and energetically productive.

"Rapid growth and the character of his work necessitates that the engineer shall continually deal with the probabilities of the future. The remarkable economies resulting from an extensive engineering study, based upon more or less uncertain future conditions, of the problem of supplying telephone service in New York City twenty years hence, were called to the attention of the members of the American Institute of Electrical Engineers in a recent paper.

"We are all familiar with the frantic struggles of engineers in charge of public utility central stations in their efforts to have modern apparatus manufactured, purchased and installed quick enough to carry the ever increasing load, but not so quick as to long stand idle and bring down the wrath of the financier. Reprehensible neglect to consider future conditions has resulted in an intolerable congestion of traffic in certain parts of this city."

He concluded by pointing out how great and varied are the resources of the great engineering corporations of the day, to which the financing and construction even of the Panama Canal would be a natural and feasible undertaking.

"The Economic Significance of the Engineers' Building," was the subject of the address by Prof. F. R. Hutton, president of the American Society of Mechanical Engineers who discussed the internal, external and educational significance of the structure, and said:

"The Engineers' Building stands to rebuke certain economic fallacies. It is a convincing answer to a contention that manual labor of arm and brawn are the only real creators of wealth in the production process, and that the reward of toil is to be directed entirely to him who contributes bodily effort. It says to such a theorist that misdirected toil and labor, which go for naught through ignorance of physical or economic law, will impoverish the community, not enrich it. Experiments are costly, when at their basis lie assumptions contrary to fact and truth. Furthermore, labor must be organized and must be directed by knowledge; its tools and its operations must also be designed and planned on a basis of knowledge and experiment.

"The director and organizer of labor is, therefore, to be com-

pensated both practically and in public consideration in proportion to his economic value. The engineer as a factor in production far transcends the significance of the mere craftsman, and this building evidences the truth and the fact. The economic future does not lie amid the dreariness of some of the contentions of the Socialist. It lies in releasing more and more the human unit from the stress which we lay upon the beast of burden. In this releasing process the engineers will be inevitably the leaders."

Dr. John Hays Hammond then spoke on behalf of the American Institute of Mining Engineers, and spoke of the building as "a clearing house of engineering information, facilitating as it does interchange of professional knowledge through the trinity library and through the personal intercourse of engineers of several specialties."

The congratulations of the Engineers' Club were tendered by Mr. T. C. Martin, its president, who recited a brief original poem that embodied "greetings from the Little House nearby." Sir W. H. Preece followed with felicitations from the Institution of Electrical Engineers of Great Britain. Mr. Walter C. Kerr, trustee of Cornell University, spoke on behalf of American universities, alluding to the building as "this unique post-graduate institution." Mr. R. A. Hatfield, past president of the Iron and Steel Institute of Great Britain, next spoke as a delegate from that body and presented a parchment address. Dr. F. Eichler, of the Freibund Deutscher Elecktrische Technic, then spoke for that society in German, and was succeeded by Mr. John F. Wallace, past president of the American Society of Civil Engineers, who brought and read the very cordial greetings of President G. H. Benzenberg of that national society, endorsing its sentiments with warm congratulations of his own.

Dr. H. Pritchett next tendered the greetings of the Massachusetts Institute of Technology and sister institutions, and spoke of the engineer as to-day the real worker in civilization—"he represents the constructive order of human development; not the destructive or the passive side." Mr. Charles Kirchhoff then presented with a beautiful illuminated address the greetings of the Verein Deutscher Gesellschaft, and Dr. Carl Hering made a charming brief address as the delegate of the Société Internationale des Electriciens of Paris. Mr. Leon Gasper spoke for the Faraday Society of Great Britain, and Dr. F. R. Archenhold, director of the Treptow Observatory, Berlin, Germany, spoke for the society of that institution for astronomical research. Captain Baxter, U. S. N., president of the Society of Naval Engineers, then made some excellent remarks on behalf of the "Associated Societies" already domiciled within the building.

Mr. Lieb, whose desk was buried elbow deep in letters and cablegrams and telegraph messages of congratulations to the Founder Societies, as well as numerous illuminated addresses from all over the world, then made a rapid summary of their contents, beginning with one from Lord Kelvin.

The next business in order was the presentation of the John Fritz gold medal by Mr. C. F. Scott, chairman of the board of award, to Dr. Alexander Graham Bell. Before this ceremony, Mr. Lieb invited Mr. Fritz to the platform, and the famous old steel engineer took his seat there amidst great applause. Mr. Scott, in his remarks, referred to the intimate connection that existed between the foundation of the medal and the creation of the building. Dr. Bell accepted the medal in brief, graceful terms, expressing his pleasure in receiving it in the presence of the venerable steelmaker himself.

Mr. Lieb then stated that in recognition of the long work of the three secretaries of the Founder Societies, it had been decided by the United Engineering Society to strike a commemorative gold medal in their honor, to be hereafter entitled the "Distinguished Service Medal," and he called upon Dr. A. R. Ledoux, past president of the Mining Engineers and of the United Engineering Society, to make the presentation.

Dr. Ledoux then made an address in which he said that the dominant note of the whole occasion had been that of gratitude for their new and splendid home; but there were other notes of gratitude to be sounded, especially in the case of these three devoted secretaries. He then rehearsed briefly the careers of Mr. Ralph W. Pope, Prof. F. R. Hutton and Dr. R. W. Raymond, and presented them each with a gold medal, thanking them in the name of the societies for services past and expressing the hope that the societies might long enjoy the benefit of their ripe experience and the inspiration of their leadership. The presentation was accompanied by great applause.

Dr. Hutton replied briefly for himself and his colleagues as the oldest in service and no longer holding the office. He spoke of the dazzling light that had once come suddenly to three mere craftsmen Gallileans on a lone hillside one night—men just doing their duty—and the message of appreciation was not to them alone but to all men. The message of a new era for engineering came with the opening of the Engineering Building

Mr. Lieb then declared the exercises closed.

Colorado Springs Decision on Street-Lighting by Arc Lamps.

Below is given the text of the decision of the Board of Arbitration in the case of the city of Colorado Springs and the Pikes Peak Hydro-Electric Company. The Board consisted of Prof. L. G. Carpenter, of Fort Collins, Col., and Messrs. E. L. Elliott and Henry Floy, of New York City.

The city claimed that the enclosed arc lamps furnished by the company had not in accordance with the provisions of the franchise, which specified "arc lamps of standard 2000 cp," and therefore a reduction should be made in all bills rendered by the company to the city, whether paid or unpaid. The arbitrators analyzed the several claims made by the two parties to the controversy, under the following heads:

I. Does the phrase "Arc lamps of standard 2000 candle-power each" mean an arc lamp giving 2000 actual candle-power, or if not, what was the generally accepted meaning at that time?

II. Do the arc lamps which the company has furnished, when operated under normal conditions, come within the meaning of the phrase "Arc lamps of standard 2000 candle-power"?

III. If the lamps furnished by the company, when operated under normal conditions, have not fulfilled the requirements of the phrase "Arc lamps of standard 2000 candle-power," what is the extent of the overcharge measured in dollars and cents due to such deficiency?

IV. Was the service which the company actually furnished from the lamps in use such as might reasonably be expected, and if not, what was the overcharge expressed in dollars and cents due to defective service?

V. Was the city estopped from claiming any refund?

The above questions were then considered in detail.

(1) The experts on both sides unanimously agree that at the date of the granting of the franchise, namely, September 8, 1898, there was no arc lamp in use for street-lighting purposes of 2000 actual candle-power and therefore the phrase cannot be taken literally. The testimony of all the experts, however, shows that there was one particular type of arc lamp, namely, a direct, constant-current series, open arc lamp taking 9.6 amperes and consuming 450 watts at the arc which was generally accepted at that time as complying with the meaning of the phrase.

(2) The arbitrators had no difficulty in reaching a conclusion on question II, since the uncontradicted testimony of the expert witnesses was to the effect that the lamps furnished by the company did not come within the meaning of this phrase.

(3) In arriving at an answer to question III, the arbitrators encountered many difficulties arising from the present imperfect state of the commercial photometry of arc lamps, the meagreness of evidence on some points, the variance of expert testimony on other points, the difficulty of selecting a satisfactory standard of comparison, and of estimating, on a dollar and

cents basis, the difference in arc lamps of such widely varying characteristics. The experts generally agreed that candle-power measurements alone do not fully express the effective values of arc lamps for street lighting, and that while the lamps used fell short of meeting the requirements of an "arc lamp of standard 2000 candle-power," they had some compensating advantages. After carefully weighing such evidence as was presented, the arbitrators reached the conclusion, everything considered, that 20 per cent, in the present case, is a fair estimate in dollars and cents of the deficiency of the lamps furnished by the company as compared with "arc lamps of standard 2000 candle-power," both types considered as operating under normal conditions.

(4) The company admitted that during a portion of the period involved in this controversy, its lamps were not operated under normal conditions, and placed in evidence a complete set of station records covering the entire period. From these records it appears that during a portion of the time the lamps were operated below their proper wattage, and for another portion of the time above their normal wattage. There appeared to be a discrepancy, however, between the wattage delivered at the lamp terminals, as computed from the station readings, and the wattage as actually measured by tests at the lamps. During the month of September, 1906, measurements were made of the exact wattage of every lamp in the city, which provided data for determining, within reasonable limits of error, the actual amount of this discrepancy in wattage. The discrepancy thus determined proved to be 6¼ per cent, which has therefore been used as a correction constant for reducing the station wattage. The corrected wattage thus obtained was used to determine the candle-power from the data given in Prof. Matthews' tests, made on lamps taken from the city circuits. These candle-powers compared with the candle-power of a lamp operated at its normal wattage (430) were expressed in per cent, which gave the means of determining the deficiency or excess of service supplied, compared with a normal lamp of this type.

(5) The arbitrators requested briefs upon question V from counsel on both sides, which were carefully considered, and the conclusion reached that there was no intention on the part of either party to evade the obligations of the contract. The good intention of the company could not, however, be held as justification for an actual deficiency in service, which has been shown to exist. On the other hand, the fact cannot be overlooked that the city should have been advised in regard to a matter of such importance, before accepting the service furnished by the company, or at least before having allowed it to continue for so long a time without protest. For these reasons the arbitrators consider that the responsibility is divided between the company and the city for the period to June 1, 1906, and therefore conclude that the reduction on account of overcharge for this period should be figured on a basis of 10 per cent in place of the 20 per cent taken after June 1, 1906.

The final conclusions of the Board were as follows:

1. That the Pikes Peak Hydro-Electric Company shall refund to the city of Colorado Springs the sum of $4,612.12. Interest on these overcharges computed at 8 per cent to April 1, 1907, amounting to $519.34, is awarded the city, in accordance with the stipulations of the agreement of arbitration.

2. That the bills of the Pikes Peak Hydro-Electric Company against the city of Colorado Springs for service rendered from June 1, 1906, to February 1, 1907, shall be reduced by the amount of $2,056.43. Interest on the bills thus corrected, due the company, computed at 8 per cent to April 1, 1907, is $307.22, which amount is awarded the Pikes Peak Hydro-Electric Company in accordance with the stipulations of the agreement of arbitration.

3. That in accordance with the statutes of Colorado the arbitrators declare that the statutory fee of three dollars per day for each arbitrator amounts to $243.00, which amount is awarded to the city of Colorado Springs to be paid by the Pikes Peak Hydro-Electric Company.

Cost of Operation of Iowa Central Stations.

In a paper read before the recent convention of the Iowa Electrical Association, Prof. L. B. Spinney presented figures on the cost of operation per dollar of income of Iowa central stations. To obtain these data forms were sent to the various central stations of the State and the figures returned were compared and averaged.

The general results of this statistical investigation are set forth in the accompanying table, which gives the average value under each item, together with the number of plants from which this average was taken, and the maximum and minimum values of the corresponding items as shown by this number of plants:

ANNUAL OPERATING EXPENSES.	No. of plants.	Cents per dollar of gross income Av.	Max.	Min.
COST OF MANUFACTURE.				
Power plant wages	21	17.7	36.9	4.46
Fuel, water, oil and waste	20	29.7	43	15
Repairs	16	2.76	10.7	.44
Miscellaneous power plant expenses	14	2.37	12.3	.20
Total cost of manufacture	23	50.5	74.8	21.7
COST OF DISTRIBUTION.				
Setting, removing and trimming arc lamps	10	1.06	2	.13
Setting, removing and reading meters	9	1.5	1.64	.20
Repairs to pole line and service, arc lamps, meters and transformers	13	3.06	11	.18
Miscellaneous distribution operating expenses	6	3.03	7.4	.55
Total cost of distribution	17	4.97	14	.18
OFFICE EXPENSES AND MANAGEMENT.				
Salaries	16	7.1	15.1	.62
General office expenses	16	1.92	7.85	.21
Total office and management expenses	20	7.99	17.0	.55
MISCELLANEOUS EXPENSES.				
Interest	16	7.66	19.4	.48
Taxes	21	1.95	5.6	.44
Insurance	13	1.07	2.5	.20
Advertising	11	1.65	2.49	.04
All other expenses	11	3.33	19.2	.50
Total miscellaneous expenses	21	10.7	46.2	2.20
Total cost of operation	31	70.3	89	44.3

April Meeting of the Chicago Section, Illuminating Engineering Society.

The Chicago section of the Illuminating Engineering Society held a meeting April 11 at the Association Restaurant, at which forty-nine were present, Mr. E. W. Lloyd presiding. After a dinner a paper was presented by Mr. T. B. Lambert on "A Method of Photometry of High Candle-Power Units." This paper took up first the method of reducing the amount of light received from a high candle-power unit by inserting between screen and lamp a rapidly revolving disk with a slot of a known angular opening, the reduction in candle-power of the ray being proportional to the amount of the disk that is not cut out. For example, if the slot were one-tenth the circumference of the disk in width it would reduce the candle-power of the ray to one-tenth that of the source. Besides making easy the comparison of high and low candle-power units on a photometer screen without excessive length of photometer bars, this plan could also be employed to advantage, he said, when comparing two rather high candle-power units. When comparing such units the light on the photometer screen is so intense that the eye cannot judge of the balance with as great accuracy as when comparing lower candle-power units. By inserting the rapidly revolving disk between the observer and the screen, the apparent illumination of the screen is so reduced that more accurate work can be done. The method is not applicable to measurement with alternating-current lamps. The paper was discussed briefly by Mr. G. H. Stickney, of West Lynn, Mass. He said that although the fundamental idea was not new, he had not heard of inserting the disk between the observer and the photometer screen. He said Prof. E. L. Nichols, of Cornell University, in his Laboratory Manual described the same scheme, but had found that when using a very narrow slot there was some error. He asked Mr. Lambert whether he had observed any such error. Mr. Lambert said that he had not, but that such errors might easily be due to mechanical error in making

the slot because with a very narrow slot it was difficult to make its width a sufficiently accurate proportion of the circumference of the disk. He was inclined to think if errors were found that they were due to mechanical rather than optical reasons.

The meeting was then given over to an exhibition and explanation of various forms of illuminometers. Two forms of Weber photometers were shown, one belonging to the chairman, Mr. Keech, and the other the property of Armour Institute, explained by Prof. C. E. Freeman. Mr. R. F. Schuchardt, of the Chicago Edison Company, explained the illuminometer made by the General Electric Company, and Prof. O. H. Basquin, of Northwestern University, exhibited a rough first model of a daylight illuminometer of his design. Mr. G. H. Stickney was called upon to explain the new foot-candle photometer devised by Mr. W. D'A. Ryan. In this photometer as a substitute for the screen there is a block of opal glass divided diagonally into halves. One side of the block is exposed to the illumination to be measured and the other side is exposed to the standard source of light. The block is viewed from one side. Balance is obtained by moving the standard source of light back and forth until the illumination in the two halves of the opal glass cube appears equal. The instrument requires no mirrors, is very simple, and since it is viewed from the side, there are no shadows from the observer or any part of the mechanism to interfere with the illumination falling on the cube.

The secretary announced that the next meeting would be held at the same place May 9, when Mr. George C. Keech would present a paper on illumination of industrial plants, giving the results of illuminometer tests on such plants.

President George S. Carson, Iowa Electrical Association.

Mr. George S. Carson, who was elected president of the Iowa Electrical Association last week, has been prominent in that association ever since its organization. He was born at Iowa City in 1862, where he has lived his entire life. He was educated

PRES. GEORGE S. CARSON.

in the public schools of Iowa City and attended the Iowa State University there for a short time. In 1882 he went into the implement business. In 1984 he was made manager of the Iowa City Electric Light Company, becoming president in 1905. He is also president of the Iowa Gas & Electric Company, of Washington, Ia. He has always been one of the most earnest advocates of keeping station records and thus locating chances for economy.

Garage and Club House of the Automobile Club of America.

The Automobile Club of America has just completed the largest and costliest building ever designed and erected exclusively for use by an automobile club, on Fifty-fourth Street, just west of Broadway, New York City. The building combines the artistic and luxurious effects required of a wealthy men's semi-social club house and the practical features of a thoroughly modern automobile garage. Although closely related, the club rooms and garage are so well segregated that one would be unaware of the presence of a garage and car storage floors for the accommodation of about 300 automobiles, with facilities for their care and repair, were he not previously informed.

The building is of reinforced concrete construction, with a steel skeleton and is fire-proof throughout. There are eight stories, and the ground floor and the upper four stories are used for garage and storage purposes. The club rooms are shut off from the garage, and the automobile elevators and rear stairways by heavy metal-covered doors. The building has a frontage of 131 ft. on Fifty-fourth Street. The main assembly room, reached by way of a grand stairway of marble, extends across the full front of the second floor. The room has a height of 25 ft. and rises through two floors. At the east end of the assembly room is a library filled with bound volumes of automobile and other kindred periodicals. There are also a grill room seating one hundred, a directors' room, a ladies' room and a billiard room besides the offices of the secretary, etc.

The top floor is set apart as a repair shop and testing department. This will be thoroughly equipped with electrically-driven lathes, drilling and grinding machines, shapers and buffers and a portable crane. There will be a full outfit of hand tools and small tools for machines, sufficient for a force of about 25 workmen. The testing department will be equipped with a dynamometer and arranged to take the full measure of efficiency, fuel consumption, friction losses, etc., of all makes of cars.

The building is lighted throughout with electricity, and telephonic communication may also be had with every part of the building. Altogether the clubhouse is thoroughly adequate for all purposes of the leading and representative automobile club of America and reflects great credit not only on the club, but on the building committee as well, the chairman of which is Dr. Schuyler S. Wheeler.

A. I. E. E. Cornell Branch.

The regular meeting of the Cornell University Branch of the American Institute of Electrical Engineers was held on April 16, 1907, in the main lecture room of Franklin Hall. Dr. Steinmetz's paper on "Lighting Phenomena in Electric Circuits" was abstracted by Mr. J. C. Peebles, Prof. Creighton's paper on "New Principles in the Design of Lightning Arresters" by Mr. E. D. Payne, and the secretary gave the results of the paper by Messrs. Rushmore and Dubois on the "Multi-Gap Lightning Arrester." All the abstracts were prepared and delivered in accordance with a recent suggestion of Prof. Geo. Shaad, and the advantages of a systematic method of abstracting papers was demonstrated. The meeting proved to be one of the most interesting of the year and after the abstracts of the papers had been delivered, a large number of local members took part in the discussion. Ninety members and visitors were present. Following the discussion a number remained for an informal smoker and further conversation regarding technical matters.

Philadelphia Meeting of the American Electrochemical Society.

The eleventh general meeting of the American Electrochemical Society will be held at the University of Pennsylvania, Philadelphia, on May 2, 3 and 4. On the morning of May 2,

at 10 a. m., the address of welcome will be delivered by Dr. Edgar F. Smith, vice-provost of the University. This address will be followed by one by the retiring president, Mr. Carl Hering, after which the session will be devoted to the reading in discussion of papers. The afternoon of the first day will be given over to visiting the chemical and engineering laboratories of the University; the works of the United Water Improvement Company where ozone is produced for water purification and the plant of the John F. Lewis & Bros. Co., where white and red leads are manufactured. The mornings of May 3 and 4, will be employed in presenting papers, while the afternoons will be spent in visiting the Disston Saw Works where the Colby electric induction furnace is used for smelting steel; the Lardner's Point Pumping Station, where very large pumping engines are in use; the Frankford Station of the Philadelphia Electric Company, where several models of electric furnaces will be shown in operation, and the United States mint, where an electrolytic plant is employed for refining gold and silver. Arrangements have been made for the presentation of a total of 31 papers, three of which deal indirectly with the subject of illumination, namely, "The Helion Lamp," by H. J. Parker; "The Titanium Arc," by R. Fleming, and "The Conduction of Vapors and Gases," by C. P. Steinmetz.

Accident to New York Edison System.

On Saturday evening last—April 20, 1907—the break down of some machinery at the Waterside No. 1 Station of the New York Edison Company caused considerable damage, but the lighting system as a whole, while subjected to a severe strain, successfully withstood the trying conditions. At 9.09, while on the peak of the evening load, one of the 5000-kw vertical turbine generators while carrying its normal load broke down suddenly, and at the same instant one of the 4000-kw engine-driven generators burned out and the engine of still another was disabled.

The two Waterside stations which had been operating in parallel were separated and a part of the load transferred to Waterside No. 2, which continued its normal operation, carrying, however, a heavy overload. The current from Waterside No. 1 Station was interrupted for a few minutes to clear the bus bars and the load on the system was carried part on Waterside No. 2 and part on the large storage batteries in the twenty-three substations distributed over different parts of the system.

Current from Waterside No. 1 was restored in fifteen minutes and in less than an hour the whole system was again operating under normal conditions. Some parts of the system, notably the downtown section, were not at all affected, and the lowest pressure, in a small section of the system, and for a few minutes only, was about 80 volts. The substation systems, the personnel and the apparatus of the generating and substations responded most satisfactorily to the unusual and trying conditions and proved once more the reliability and flexibility of the Edison system on Manhattan Island.

CURRENT NEWS AND NOTES.

POULSEN WIRELESS SYSTEM.—A despatch from Copenhagen, Denmark, states that Vladimir Poulsen is experimenting with his new wireless telegraph system between that city and the Danish West Indies. Excellent results are stated to have been obtained.

TELEPHONY IN PHILADELPHIA.—The Bell Telephone Co., of Philadelphia, has announced a reduction in its rates for local pay station calls to 5 cents to all points in the city except from pay stations in hotels where 10 cents will still be charged. Sixteen thousand stations are affected by the order.

CORRECTION.—In the description of the Rateau turbo-generator unit printed in our issue of March 23, it was stated that the dynamo was a Western Electric generator. A correct statement would have been that the generator was designed and built under the specifications and patents of the Rateau Turbine Company by the Western Electric Company.

PERFUMED SUBWAYS.—A special dispatch from Paris of April 20, says that the experiment of perfuming the Paris subway has been made with great success. At certain hours of the day a car fitted with a special scent-distributing apparatus is run over the lines, and for a period after its passage the stations are filled with the odors of Araby the blest.

N. E. L. A. POSTALS.—The National Electric Light Association is issuing a series of very pretty postal cards in regard to its June annual convention at Washington. These cards give colored views of the White House, National Capitol, Washington Monument, Library of Congress, Mt. Vernon and other famous places and objects of interest. President Williams says that everything points to a very large attendance.

ELECTRIC POWER FOR CANAL BOATS.—Advices from Allentown, Pa., are to the effect that the Lehigh Coal & Navigation Company purposes experimenting with electricity as a motive power for the propulsion of its canal boats, in place of mules. A new boat-building plant with modern machinery will be erected at Weissport. Preliminary work for the electrical experiments is said to be under way at Mauch Chunk. The company's plant at Lansford will furnish the power.

PHYSICS OF THE ELECTRON.—On the evening of Wednesday, May 1, Prof. M. I. Pupin will present the last paper of the academic year before the Electrical Engineering Society of Columbia University. The paper, entitled "The Physics of the Electron," is to be illustrated with experimental demonstrations and promises to be exceptionally interesting. 8:15 p. m. and Room No. 301, Engineering Building of the University are as usual the time and place appointed for the meeting.

KAKABEKA FALLS POWER PLANT.—A project long discussed and variously considered has at last been crystalized into a fact by the Kaministiquia Power Company, and Fort William, Ontario, is now being supplied with electrical energy generated at Kakabeka Falls, on the Kaministiquia River, 25 miles west of Fort William. The energy is transmitted to that town by two lines on a single right of way and is there distributed from a sub-station. The electrical equipment is of the most modern and approved pattern. The plant is entirely fireproof, being built of brick and structural steel and for equipment and general arrangement will compare favorably with any on the continent. At the generating station the equipment consists of two 5000-kw, 4000-volt, three-phase alternators, each direct connected to a 6786-hp twin reaction water turbine; two 150-kw, 125-volt, direct-current generators, each direct connected to a 250-hp turbine, and two banks of three transformers each, each transformer of 2200-kw capacity of the air blast type, 2300 to 14,475 volts. The electricity is conducted in leaden cased cables laid in the ducts laid in the floor from the generators to selector switches, located in cells near the transformer air chamber. For handling the heavy parts of the machines a 35-ton crane has been installed. The crane motors are supplied with current from the exciter generators. The switchboard is thoroughly up to date in the manner of control and also in the apparatus used. The transformers are set in concrete cells in a gallery beneath the 4000-volt busses, and the current transformers are placed on concrete shelves in similar cells behind the high tension oil switches. It is difficult to realize what the installation of this plant really means to the cities of Fort William and Port Arthur. Admirably located at the end of Canada's extensive system of waterways, these towns bid fair to become great industrial centers now that an abundant supply of electrical power is available at reasonable rates. A number of big industries are nearing completion while several others are projected.

CANADIAN SUBSCRIPTIONS.—Beginning May 8, the new postal arrangements between Canada and the United States will go into effect, and will make it necessary to pay four cents per pound for copies of such papers as the ELECTRICAL WORLD mailed to Canada. To meet partly the increased cost, the subscription price of this journal to Canada will hereafter be $4.50 per year. On the monthly edition the price will be $1.50. All prepaid subscriptions will be carried to expiration at the old rate, but all future renewals and new subscriptions will be at the new rate.

AGAINST MUNICIPAL OWNERSHIP.—The plan of municipal ownership of a lighting plant by the borough of Rutherford, N. J., was rejected at a public meeting called by Mayor Andrew H. Brinkerhoff last week. A committee of fifteen was appointed a year ago to investigate the question. Nine members of the committee presented a majority report, with which the other six disagreed. "It should be mentioned," the majority report says, "that every member of our committee is, in the abstract, in favor of municipal ownership. As a concrete proposition, however, the facts elicited compel a contrary judgment, so far as Rutherford is concerned, at the present time." The minority report agreed that it was inadvisable for the borough to install at the present time a municipal gas plant, but advocated the establishment of an electric plant.

NIAGARA POWER IN CANADA.—The Toronto *Mail* says that the Hydro-Electric Power Commission has received offers of power, delivered at Niagara Falls, from the three companies operating on the Canadian side of the Falls. The concerns are the Canadian Niagara Development Company, the Ontario Power Company and the Electrical Development Company. No announcement of the prices has been made. The fact that the commission is thus assured of power on acceptable terms places it in a position of strength. Requests for formal contracts for a supply of energy have been received by the Hydro-Electric Power Commission from all the Councils of towns in the Western Ontario Niagara Power Union of Municipalities, with few exceptions. Those who have not applied are Hespeler, Preston, Paris, Hamilton, Toronto Junction and Waterloo. The majority of the Councils will, it is expected, pass the resolutions at their next meetings, and send the demand for contracts to the commission shortly afterward. The commissioners will then submit contracts setting forth the final terms on which electricity will be supplied.

FAST TELEGRAPHY.—Anent the recent Institute paper and discussion over automatic and fast telegraphy, the following item from the *New York Times* would show that once in a while some pretty speedy work is done under the old conditions: "W. J. Wollman, of J. S. Bache & Co., who takes a good deal of pride in the facilities which his firm possesses in the way of telegraphic communication with various parts of the country, was called upon several times last week by friends who wanted information regarding the earthquakes that were reported from several Southern points. One such inquiry came from a man who was very anxious about the situation in New Orleans, and who wanted to know just how severe had been the shock that was reported to have occurred in that city. He called Mr. Wollman on the telephone, and was told that if he would hold the wire Mr. Wollman would find out for him. The man held the wire, and in seven minutes' time he was given the answer that had come from New Orleans over the firm's private wire. It took just that length of time to send an inquiry to New Orleans and to get the answer back to this city. The incident is one which serves to illustrate how well equipped Wall Street is in the matter of communication with other parts of the country."

TELEPHONE GARDENS.—Further note is made in the bulletin of the American Civic Association, of the flower gardens for operators established first by the Chicago Telephone Company. Other companies are now to follow the unique example of the Chicago company, St. Louis having already made the start. Such exchanges as had a plot of ground were given blossom beds. The operators were offered individual patches of ground, and rivalry helped to make the experiment a success. One planted mignonette and vied with another who chose verbena seeds; a third kept a clump of sweet peas as weedless as her neighbors, who had geraniums. The company furnished the seeds, the ground all spaded and ready, and the girls chose their plot and their seeds. A real garden was new to many of the girls. At first they made many mistakes, pulling up many plants and carefully leaving sturdy weeds instead. They got down on their knees and dug in the dirt until they became quite proficient gardeners, enjoying it all meanwhile more than had been expected. Some of the operators, of a thrifty bent, grew lettuce, radishes and strawberries. Their crops more than once were proudly picked by their owners to be served with the noon luncheon which the company furnishes free to its operators at all the exchanges. Roof-gardens are said to be a possibility of the future at the exchanges where no ground is available. In the down-town district of Chicago it is obviously impossible to use any ground for growing flowers, although at the down-town as well as outlying exchanges window-boxes of flowers are numerous and solicitously watched by young women employees. They have had help for all the heavy work, but the inherent love of women for flowers was given an opportunity to grow and to blossom.

AMENDING UTILITIES BILL.—Amendments to the Public Utilities bill have been proposed by the City Club to the committees of the New York Legislature now in conference upon the bill. It is the idea of the club that the proposed amendments will strengthen the character of the proposed commissions. The club has taken this action, believing that the broad powers of the present bill should not be conferred upon a commission whose stability and future independence are not fully guaranteed by the act which creates it. The amendments are in effect these: To give any commissioner proposed to be removed by the Governor an opportunity to submit an answer to the reasons cited for his removal; to extend the term of office from five to ten years; to introduce an age limit; to increase the salaries of both commissioners and counsel from $10,000 to $15,000; to provide a method for fixing exact penalties, and to provide that penalties paid by corporations in the first district be paid into the city instead of the State treasury. Mr. J. N. Seligman, the banker, has written Governor Hughes as follows: "I believe public service corporations should have the right to contract for the operation of their works by others without the consent of the commission, provided such contract does not cover more than a limited period of time, say, two or three years. The new commissions will be very busy during the first few years, and the delays that will result if they must approve every contract made by a gas or electric company or by a railroad, affecting franchises, will bear hardly upon the companies. If the commission is given the right at any time, upon proper hearing, to order the cancellation of contracts, the public interests will be amply safeguarded and at the same time the corporations would not be unduly restricted. Other provisions of the bill would prohibit an individual or a banking firm in the ordinary course of its business, from pledging without the consent of the commission, more than 10 per cent of the stock of a public service corporation as security for a loan. Surely no public good can be served by such a prohibition. The object of the bill, I take it, is to do away with holding companies as a means of stock watering. Why should there not be excluded from such prohibition the holding of stock by companies the capital stock of which has been paid at par in cash? Also, the wording of the act would seem to prevent the acquisition by companies now controlling a large majority of the capital stock of a public service company, of small amounts of minority stock still outstanding. This is a great hardship to impose upon minority stockholders, depriving them of practically the only market they have for their holdings."

TELEPHONY IN SIAM.—Mr. Hamilton King, minister to Siam, reports from Bangkok that the Siamese Government has concluded to submit the specifications for a complete telephone system for the city of Bangkok to a limited number of houses in Europe and America for their bids.

LOWER PLATINUM.—It is stated that a metal very useful in the electrical arts—platinum—began two weeks ago to go down in price, and since then has fallen $4 an ounce, going down from $38, the top mark, to $34. Refiners say that there is a likelihood of a further decline. The manufacturers using platinum, who had been worrying over the reports of the scarcity of the metal and the unusual high prices, are breathing easier. It was said several months ago that the Russian government, which controls the mines in the Ural Mountains, where most of the platinum is found, was restricting the output. Meantime the search for platinum continues in this country.

NOTES ON WIRELESS.—Admiral H. N. Manney, U. S. N., when interviewed in London last week on various naval subjects said: "I have been gratified to learn as a result of attending the wireless telegraphy conference in Berlin that we also still lead in this science. The news that has just reached me of the new record for land messages from Pensacola to Point Lome, on the California Coast, 1768 miles, shows that we are maintaining our supremacy. That was the first wireless message from the Atlantic to the Pacific overland. My observations abroad confirm the belief that the spark system of wireless telegraphy, which we use, has advantages over the Poulsen system. In the Poulsen system, used largely abroad, the current is said to be continuous, but is not of a frequency of oscillation as great as 700,000 per second. Some of the experts we met abroad hold that the Poulsen system will ultimately displace the spark system, because in some cases the spark must travel 2300 miles to complete the circuit. This is a much greater distance than it has ever attained."

COPPER TELEPHONE WIRE.—Advices from Boston say that the statement that telephone companies are substituting iron for copper wire on account of the scarcity and high price of the red metal has no foundation in fact, at least so far as the Bell system is concerned. Neither the parent company nor any of its subsidiaries is at present using a pound of iron wire in places where copper wire has been used before. The American Bell companies are using iron wire just as they have for years. The engineering specifications which standardize Bell construction throughout the United States, call for the use of iron wire only on short lines of not over forty miles, where the congestion of traffic over main copper routes requires an auxiliary service. The American Bell system used in 1906 about 55,000,000 pounds of copper wire, thus placing it among the three or four great copper consumers of the country. The 1907 total will probably show some reduction from this figure, but not on account of the cheaper iron wire.

ARTESIAN DYNAMO DRIVING.—Advices from South Norwalk, Conn., state that ex-Mayor Mortimer M. Lee purposes to get power for lamps and all electrical equipment for himself and his neighbors by utilizing an artesian well on his premises. E. N. Sipperley, the contractor who bored the well, is of the opinion that he has tapped the famous underground New England River which, geologists declare, passes under Connecticut and Long Island, and whose mouth is in the depths of the Atlantic Ocean. It is a 6-in. well and was sunk to a depth of 700 ft. At first it threw water 15 ft. in the air with a flow of 30 gallons per minute and a pressure of 25 lbs. to the square inch. Of late the flow and the force have more than doubled, with the result that Mr. Lee has had trouble in keping his plumbing intact. He has given out a contract to affix a dynamo to the supply of water which will generate electricity sufficient to light and equip Mr. Lee's house and the homes of his neighbors as well. Mr. Lee is a member of the firm of Lee & Houton, New York silk importers. As our readers know, the driving of dynamos by artesian wells is not new, but has been practiced in the West.

PATENTS IN ENGLAND.—Special cable dispatches from England of April 18 report that the Patents and Designs bill, introduced in the House of Commons last week by the President of the Board of Trade, Mr. Lloyd-George, and which subsequently passed unanimously its second reading, is of particular interest to American manufacturers of machinery largely used in British factories, who, having secured patent rights in Great Britain, continue to supply British factories with machines made in America. The measure is designed to compel these manufacturers to make in Great Britain the machines which they sell or lease here. The bill will become a law. Clause 10 of the bill enacts that at any time not less than three years after the grant of a patent any person interested may apply for the revocation of the patent on the ground that the patented article is manufactured exclusively or mainly outside the United Kingdom. The Controller may revoke the patent unless the patentee proves that the patented article is manufactured to an adequate extent in the United Kingdom or "gives satisfactory reasons why the article is not so manufactured." The *Shoe and Leather Record*, the official organ of the shoe trade, believes this clause is aimed at shoe machinery invented and manufactured in America and patented but not made in Great Britain. It would, however, affect other industries.

CALLING A HALT.—An important circular has been signed by a number of railroad supply houses in Chicago and Pittsburg, which has recently been given wide circulation. The circular draws attention to the fact that there are about 400 bills, all of them affecting more or less unfavorably the interests of the railroads, now pending in the several State Legislatures. The manufacturers of railroad supplies and the dealers in them who have signed the circular suggest that the most effective way to check this movement against the railroads would be a letter addressed to the governor of his State by every man who may be convinced that the legislation against the railroads should be halted. The circulation of this document by a large body of business men is in line with the resolutions recently adopted by Boards of Trade in Philadelphia and other cities deprecating the general outcry against corporations and pointing out the harm that is likely to come from the present agitation unless it is kept within bounds. The circular says: "We know that if present conditions continue, all classes of labor and every business interest will be injured. We know that every manufacturer, every jobber, and every retailer in the United States does business directly or indirectly with railroads or their officials or employees. We know that the railroad interest is, next to farming, the largest in the country. We know that when the railroads begin to economize it seriously affects every other business. We know that under such conditions labor will suffer very greatly and that men will be seeking employment. We believe that now is the time to act, before the damage is done, and that every man who reads this should act. If 10 per cent of the men in the United States would to-day write to the governors of the States in which they live, and to their representatives in the State Legislature, stating that this agitation was injuring their business and that it must be stopped, it would be stopped. Every one of these public servants would listen, because every writer is a voter. We do not object to the regulation of the railroads by the National Government in the proper manner, but we do object to going through a period of hard times similar to that between 1893 and 1897 in order to accomplish alleged railroad reform. The situation is serious. Immediate action is necessary or business will diminish, bank accounts will be reduced, profits will disappear, salaries will be cut, wages decreased, men discharged, and thousands will be looking for work. Every laboring man, every business man, every professional man is and will be affected. He should act now."

New Power Plant of the Central Pennsylvania Traction Company at Harrisburg, Pa.

THE Central Pennsylvania Traction Company operates about 64 miles of electric railway in Harrisburg, Steelton, Highspire, Middletown, Penbrook, Progress, Linglestown, Oberlin, Paxtang and Hummelstown. Its new power house is located immediately adjacent to the old No. 1 station on South Cameron Street, Harrisburg; and about 1¼ miles from the center of gravity of the system, figured on power consumption. Other sites were considered, two of which would have been more desirable on account of being nearer the center of gravity of the system and also nearer the Susquehanna River. For various reasons neither of these could be obtained and it was finally decided to locate the plant where it now stands, using the funds which would have been required to purchase a new site, for building a water-supply line to the Susquehanna River which is about 1100 feet distant in a direct line.

The building is a composite structure having a steel skeleton with concrete curtain walls; the columns being designed simply to carry the crane and roof loads, and only sufficient lateral bracing in the shape of diagonal rods was used to maintain the frame work in position while filling in the walls. The walls are of mass concrete, generally 12 inches thick, and were carried up by filling in plain forms about three feet deep; the forms being secured to and held in alignment by the columns. The building is divided longitudinally into two rooms of nearly equal size, the front portion being occupied by the main engines and switchboard and the rear by the boiler equipment.

The foundations for the building consist of continuous concrete walls five to eight feet deep with extended base, six to eight feet wide at the bottom. This is not reinforced, but is stepped off. The site on which the building is erected is made up mostly of top clay filling from an old quarry, the street grade being about 20 feet above rock. This fill is an irregular strata of clay and wet loamy soil which gave an irregular and more or less uncertain bearing value. The foundations as placed were designed for a maximum bearing on the sub soil of 3000 pounds per square foot. When excavating for the rear wall foundations, however, the sub soil was found so completely saturated with water as to be considered unsafe with the above described foundation and piers were carried down to within four or five feet of rock, where a stratum of hard, dry, gravelly clay was found; the continuous footing wall being afterwards put in on top of these piers. The foundations for the interior columns supporting the coal bunkers and economizer floor were also carried to the lower stratum of clay.

The situation was ideal for the use of concrete piles and the designer would have preferred this method; but found on investigation that more time would have been required to place these piles, than was available. The results have been altogether satisfactory and there has been practically no settlement.

The roofing consists of 8-in. steel channels placed about 6 ins. between centers and resting on steel trusses, the whole being covered with 3-in. slab cinder concrete reinforced with ⅜-in. round rods and this in turn covered with four-ply tar paper and slag roofing. The façade of the building was designed by Mr. C. H. Lloyd, a local architect, whose design was submitted in competition with two others. The front wall of the building is of mass concrete as is the rest of the building, with the exception that the face of the wall was made of cement and sand mortar, mixed fairly dry which was placed in forms and back-filled with rough concrete. This gives the building a smooth and even finish, as though made of dressed stone, although no effort was made to disguise the fact that the building is of concrete construction. The windows in the front of the building and opening into the engine room are very large, measuring 10 feet wide by 23 feet high. There are two swinging sashes on vertical pivots and one large transom, all being filled with plate glass. The windows extend nearly to the floor line, thus giving abundant light and enabling people in passing cars to get a good view of the dynamo room.

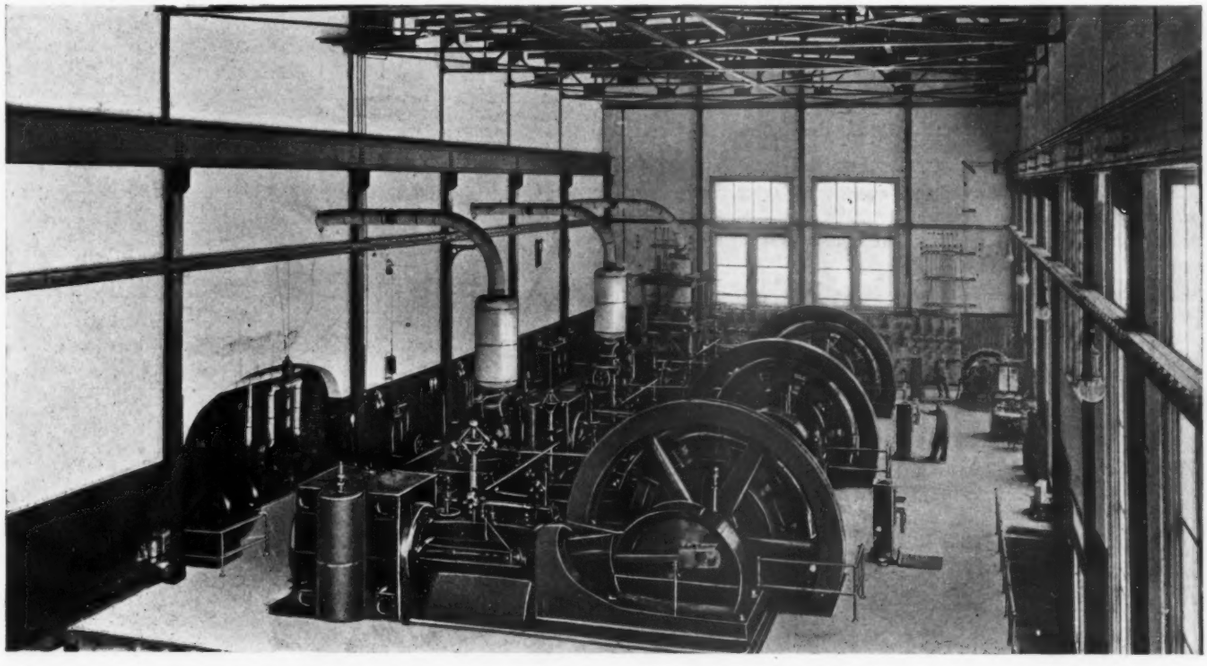


Fig. 1.—Generator Room in the Central Pennsylvania Traction Company's Power House.

The main floor of the engine room is about eight feet above the level of the street while the floor of the boiler room is five feet lower than that of the engine room. The building is approximately 175 feet long by 103 feet deep, and only a trifle more than half the floor area is occupied by the present equipment. The rapid increase in the power requirements of the traction company in the past few years indicated the advisability of providing ample space for future growth. The central bay of the boiler room is used as a pump room. In this are

placed boiler feed-water pumps, circulating water and air pumps, feed-water heaters, condenser, etc. The floor above, or roof, of the pump room is built on steel beams and carries the economizer and main smoke flue; the flue occupying the center of the floor space, and the present economizer installation space being adjacent to the boilers. The main flue passes out on the level of this elevated floor directly to the chimney located 23 feet to the rear of the building. A rectangular coal bin having a capacity of 600 tons extends the full length of the space occupied by the boilers; the bin being constructed of plate girder sides and I-beam floor, lined throughout with concrete. A coal gate is placed directly in front of each boiler and the coal is delivered to the boiler room floor by a traveling weighing hopper.

Clearfield coal is delivered to the building over a siding from the Pennsylvania Railroad running between the rear wall of the building and the chimney. Near the center of the building and under the track is a hopper which receives the coal as it is dumped from the cars. The coal passes to a crusher and thence to the boot of a vertical chain and bucket elevator. This latter delivers the coal to a screw conveyor in the roof of the building from which it is distributed to the coal bin previously mentioned.

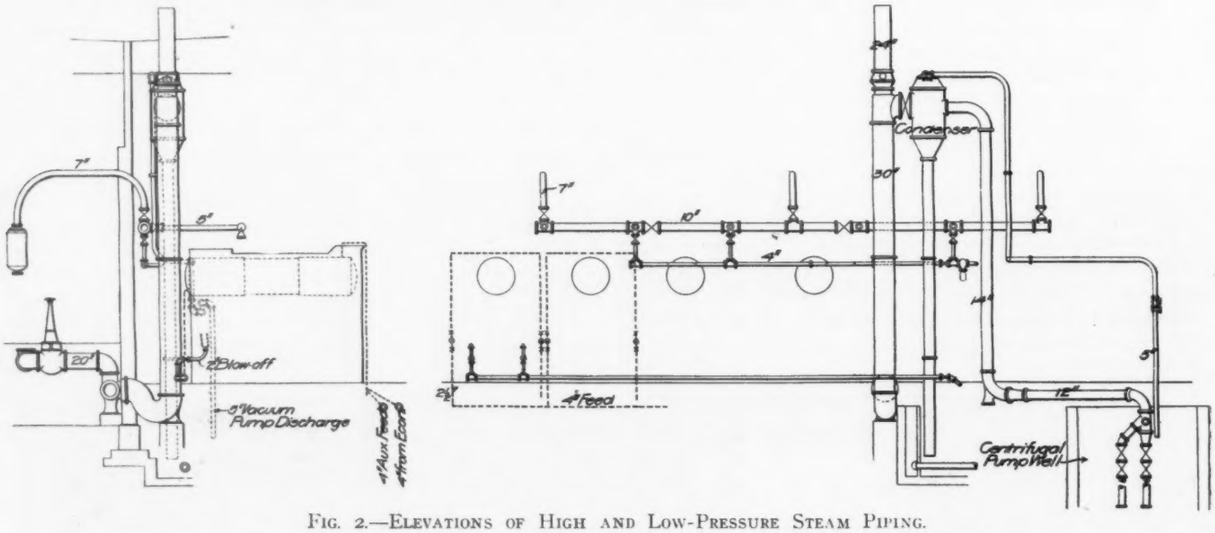


Fig. 2.—Elevations of High and Low-Pressure Steam Piping.

Ashes drop, from the hand-fired shaking grates, to pits from which they are removed in a steel dump car and delivered to the elevator boot mentioned. The ashes are then elevated to a bin located in the roof of the building adjacent to the elevator; the bin having a capacity of about one car load. The proximity of the elevator and the bin obviates the necessity of handling the ashes by the screw conveyor, and the ashes are removed to the outside of the building by means of a gate and chute. By means of this arrangement, the car on the track outside may be emptied of its coal and filled with ashes without being moved from its position. The coal and ash handling

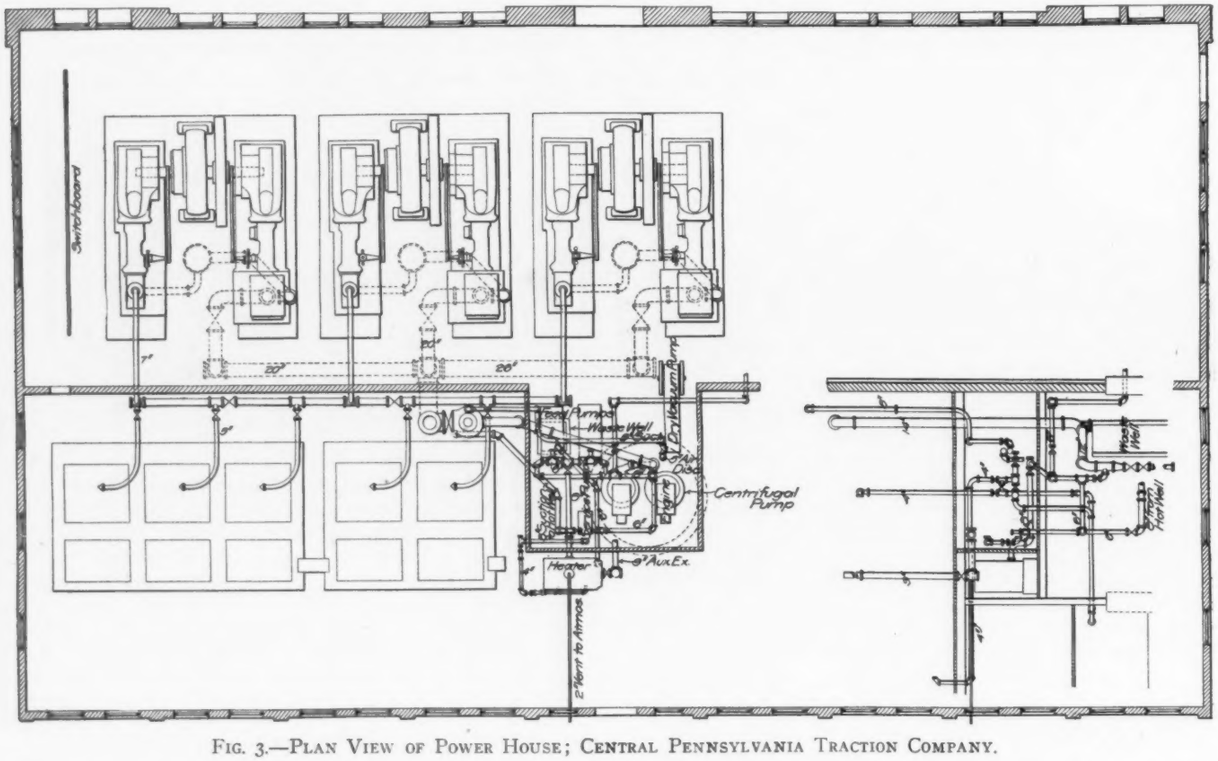


Fig. 3.—Plan View of Power House; Central Pennsylvania Traction Company.

machinery has a capacity of 20 tons per hour and was furnished by the Jeffrey Manufacturing Company, Columbus, Ohio.

The chimney was constructed by the Weber Steel Concrete Chimney Company, of Chicago. It has an internal diameter of 10 feet and is 190 feet high above the boiler room floor and 215 feet above the foundation. The chimney stands on a circular base 25 feet in diameter and about three feet thick and for 75 feet of its height above the boiler room level has two shells, an inner shell of 4 inches, a 4-in. air space and an outer shell of 7 inches. The upper 115 feet has a single ring 5 inches thick, and the chimney is reinforced throughout with 1¼ by 1¼ inch tees, vertically, and ¾-in. round rods, horizontally. The main flue opening is 7½ ft. by 12½ ft., the bottom of

FIG. 4.—GENERAL VIEW OF BOILER ROOM.

the opening being 18 ft. above ground. The chimney is designed to withstand a wind pressure of 50 pounds per square foot which is equivalent to a 100 mile gale.

The present boiler equipment consists of five, 327 hp water-tube boilers built by the E. Keeler Company, of Williamsport. Pa. Each boiler is equipped with 164 four-inch wrought iron tubes of No. 9 gauge and with a single drum 54 ins. in diameter. Foster superheaters built by the Power Specialty Company of New York City superheat the steam 100 degrees. Regan shaking-grates are used, and the steam pressure carried is 175 pounds.

As previously stated, it is the intention to secure all water for boiler and condenser purposes from the Susquehanna River. This is to be accomplished by boring a tunnel about 5 feet high and 6 feet wide through the solid lime stone rock, 40 feet below the surface of the ground. The tunnel starts from a shaft 15 ft. in diameter directly under the pump room and passes out under the center of the chimney, most of the tunnel being under the yard of the Central Iron and Steel Company, which latter concern is interested with the traction company in the execution of the work, as it intends to utilize the same source of water supply later on. From the river bank where the terminal shaft is placed, there extends out into the river about 700 feet, a 36-in. wood stave pipe placed in a trench cut in the rock bottom of the river. The construction of this tunnel and intake is now well under way and the capacity of it will be about 15,000,000 to 20,000,000 gallons daily.

The steam piping for the plant was installed by the Best Manufacturing Company, of Pittsburg, and is designed throughout for a pressure of 200 pounds. All flanges are of wrought steel, and Van Stone joints and Merwith gaskets are employed. A 10-in. main receives the steam from the five boilers and from this lead 7-in. goose necks connecting with each main engine immediately above the high pressure cylinder. Above the throttle of each engine is located a Cochrane receiver and separator which also acts as a reservoir of steam. A 4-in. main runs a few feet below the main header from which connections are taken for the auxiliary pumps. This main also acts as a drain for the main header. The exhaust steam from the three main engines is passed through an Alberger condenser while that from the auxiliaries is passed through a Cochrane open heater. Feed water is ordinarily taken from the hot well to the open heater from which the boiler feed-water pumps deliver it to the economizer, thence to the boilers where it arrives normally at a temperature of approximately 300 degrees. The economizer was built by the Green Fuel Economizer Company, of Matteawan, N. Y.

The condenser is a 30-in. jet type, barometric, built by the Alberger Condenser Company, of New York City. The water is delivered to the condenser by means of vertical shaft centrifugal pumps in duplicate, each of which has a capacity of 1000 gallons of water per minute. This type of pump was adopted for the plant on account of the fluctuation in the height of the water supply which is intended ultimately to come from the Susquehanna River. The pump floor is located 33 feet above extreme low water. As the river has a maximum rise of 27 feet and it was desired to have all of the moving machinery of the plant under the direct control of the plant engineer, besides making it easy of access, the layout was arranged accordingly. The centrifugal pumps and the horizontal rotating engines driving the same were furnished by the Morris Machine Works, Baldwinsville, N. Y. The boiler feed-water pumps are of Worthington make.

The main engines were furnished by the Allis-Chalmers Company, each of the three engines being identical in construction. The engines are of the horizontal, cross-compound, rolling mill type with cylinders 22 by 48 by 42 ins. Each is provided with double eccentrics and butterfly automatic stop valves. The engines have a guaranteed rating on 165 pounds steam pressure with 75 degrees superheat, of 984 indicated horsepower with a steam consumption of not over 12.4 pounds; the speed being 100 r. p. m. and the vacuum reading 26 ins. Without superheated steam, the steam consumption is guar-

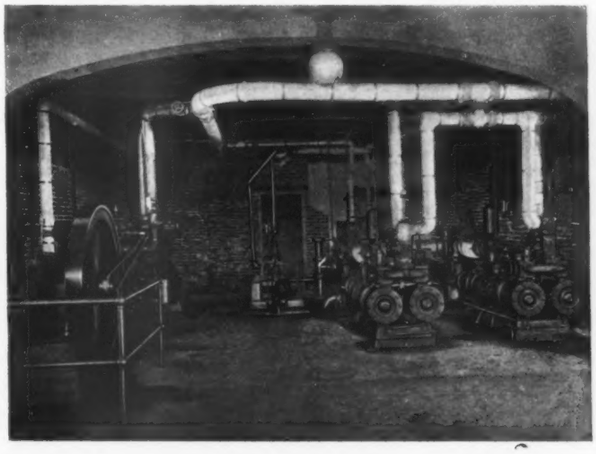


FIG. 5.—PUMP ROOM.

anteed at 13¼ pounds per horsepower per hour. Each engine weighs approximately 220,000 pounds and has a clearance of 5 per cent on both the high and low pressure sides. The mechanical efficiency is guaranteed to be 94 per cent. Garlock metallic packing is used on the piston rods and Richardson sight-feed mechanical oiling sets are fitted on the cylinders. The balance of the oiling is done on a gravity system. The main shaft of the engine carries a 50,000 pound fly-wheel and the armature of the generator.

The generators are of the Bullock railway type having a rating of 600 volts and 1084 amperes and being guaranteed to run 24 hours under full load without sparking and without heating the windings more than 35 degrees, and the armature

more than 40 degrees above the temperature of the surrounding atmosphere. They are also guaranteed to carry an overload of 50 per cent following a 24-hour run for one hour, without heating the windings more than 55 degrees Centigrade and to carry a momentary overload of 100 per cent. The guaranteed efficiency of the generators at three-quarter load is 93.8 per cent and at full load, 94.2 per cent. Each generator has ten poles and weighs 115,000 pounds. The armature weighs approximately 38,500 pounds and the dimensions of the commutator are 80 ins. by 12¼ ins. A view of the generator room is given in Fig. 1.

The switchboard was built by the Westinghouse Electric and Manufacturing Company. It is made up of 26 panels apportioned as follows: four generator panels, one being blank; three storage battery panels; one total load panel; eleven unboosted feeder panels; four boosted feeder panels; two booster panels and one blank panel. No boosters have as yet been installed. Each generator panel is equipped with a circuit breaker, indicating ammeter, quick-break switch and Thomson watt-hour meter, together with voltmeter plugs and receptacles for the voltmeters on the swinging brackets at the end of the board, besides the usual field rheostat, the resistance for which is placed below the floor. The three storage battery panels were furnished by the Electric Storage Battery Company, of Philadelphia. The panels are provided with the usual controlling devices including a carbon regulator. The storage battery is installed in a building immediately adjoining the power house and is made up of 288 cells. The total load panel is equipped with an indicating ammeter, a recording ammeter and a recording voltmeter. Each of the feeder panels is equipped with a single-pole, quick-break switch, a circuit breaker, an indicating ammeter and a watt-hour meter. This makes a very complete feeder panel, as it is not the usual practice for railway companies to place a watt-hour meter on each feeder. A view of the switchboard is given in Fig. 6.

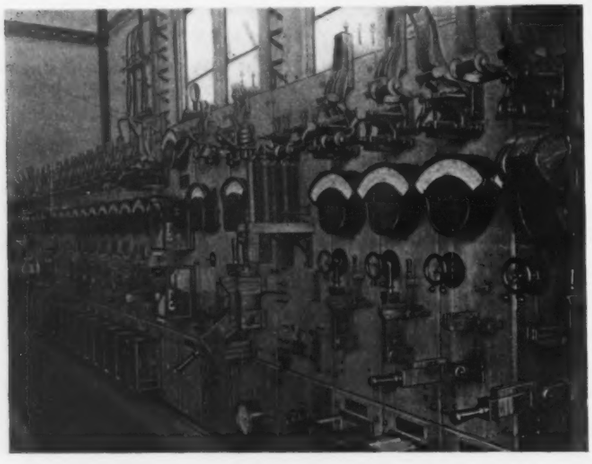


FIG. 6.—SWITCHBOARD.

The total cost of the station exclusive of the intake tunnel is about $230,000. Excavations for foundations were begun early in January last year, and power was furnished on the line late in May. The station took the entire load and three old stations were abandoned in October. Owing to the large increase in the number of cars operated and alterations in schedules, the station is furnishing an average of 60 per cent more power than was required to operate the system a year ago.

The entire plant was designed and constructed under the direct supervision of Mr. Mason D. Pratt, of Harrisburg, to whom we are indebted for many courtesies extended in the preparation of this article. Associated with Mr. Pratt, were Mr. C. O. Mailloux and Mr. W. C. Gotshall, of New York City, acting as advisory engineers.

The Power Plant of the Malden Electric Company.

One of the most interesting central stations now operating in the suburban districts around Boston is the remodelled plant of the Malden Electric Company. This station has been developed from a line shaft and belt basis to an efficient direct-connected organization whose entire output is either three-phase or single-phase 2300-volt, 60-cycle alternating current. All the changes involved in this development have been made without interruption of service on account of construction exigencies, and in many respects the plant is to-day as homogeneous as if specially designed for the present equipment The coal-handling system, the boiler room and the most important piping are especially unified; the switchboard is equipped with panels logically arranged for the different classes of service, and the generating units are efficient in type, although necessarily somewhat scattered.

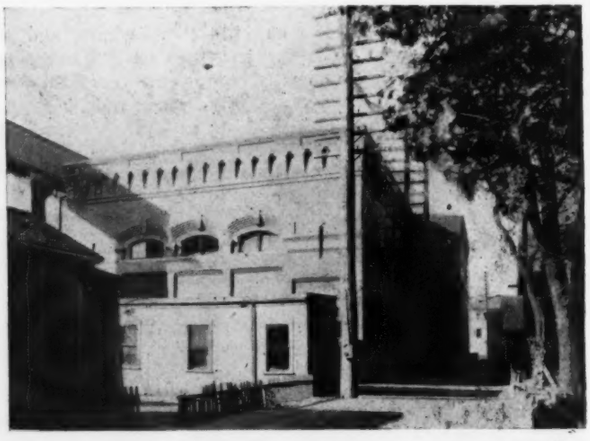


FIG. 1.—EXTERIOR OF MALDEN PLANT.

The plant is located in a narrow court off Centre Street, Malden, an exterior view of the building being shown in Fig. 1. Although practically surrounded by other buildings the station was laid out with a view toward an enlargement of its capacity in the future, and both on the boiler and engine rooms additional equipment can be installed. The present normal rating of the plant is 2125 kw, but the capacity will shortly be increased 59 per cent to 3375 kw by the addition of a 1500-kw Westinghouse-Parsons turbo-alternator which has been ordered by the company. This unit will replace the smallest machine at present in the station. In general design the plant consists of a

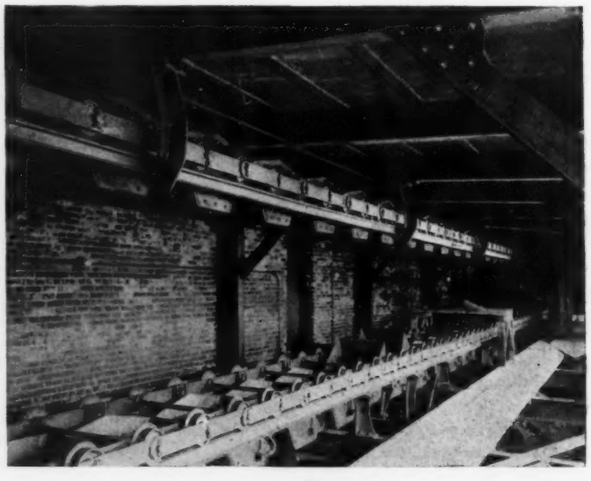


FIG. 2.—COAL CONVEYOR.

boiler room 82 ft. x 41 ft., a pump room 65 ft. x 35 ft., and an engine room 147 ft. x 54 ft. There are also a fireproof wire tower, 40 ft. x 9 ft. 4 in.; and a cooling tower, coal-handling passageways and overhead bunker installation. All the steam piping supplying the generating units is at present entirely overhead work, but plans are being matured for a considerable amount of underground conduit construction. The territory

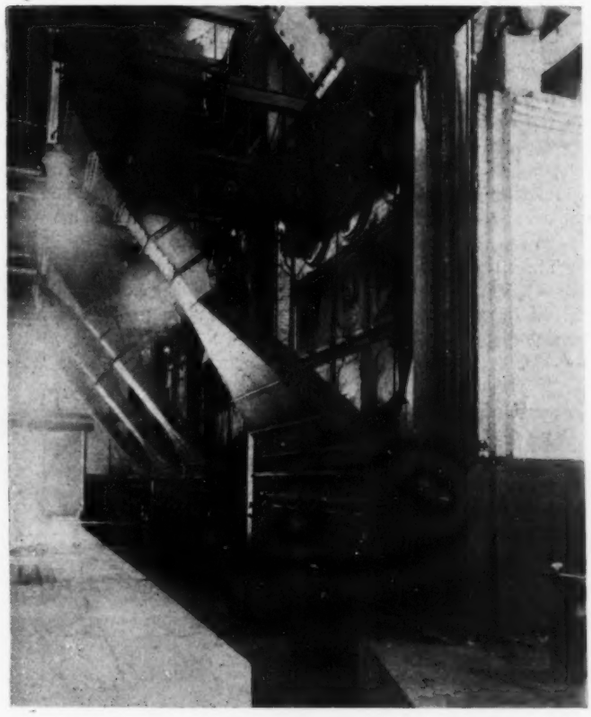


FIG. 3.—WEIGHING HOPPERS, CHUTES, STOKERS, ETC.

served by the station includes the cities of Malden, Melrose and Everett, and the town of Medford. The area of distribution is about 25 sq. miles.

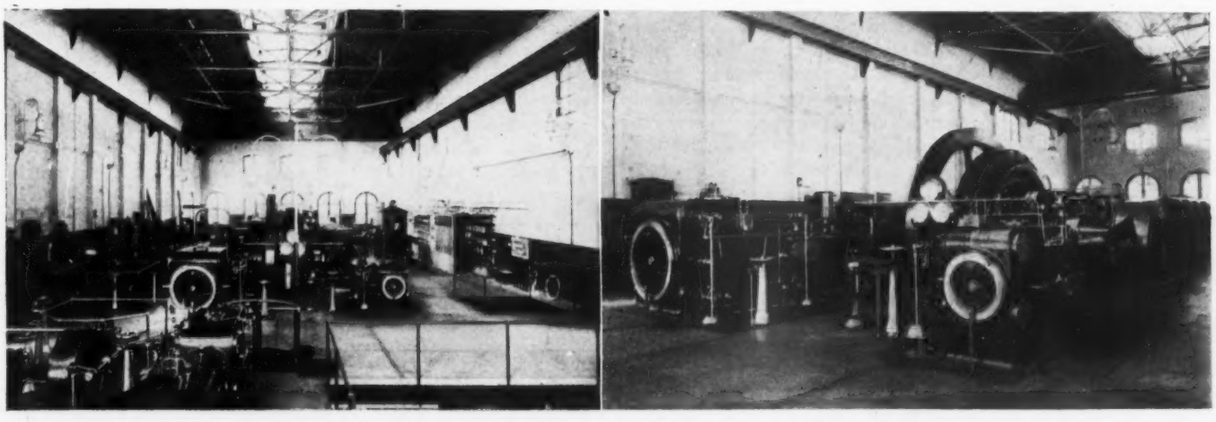
Coal is brought to the plant in wagons and is not trucked by manual labor in its course of travel from the carts to the grates. The coal carts are driven into the station yard over a hopper set in the ground and are dumped into a vertical crusher which is installed in the hopper. The crusher is belt driven by a three-phase, 15-hp, 550-volt induction motor of General Electric make, the motor being mounted in a small house on the ground level to secure easy access. The crusher is equipped with eight feed lubricators mounted in the motor house at the top of oil supply pipes leading to the bearings below ground. The coal is elevated from the crusher by a bucket conveyor having a capacity of 60 tons per hour. This was supplied by the Steel Cable Engineering Company, of Everett, Mass., and is shown in Fig. 2. It carries the coal to a pocket located above the boilers, the empty buckets returning to the hopper by a vertical runway.

The main power-station building is 37 ft. 7 in. high, of brick, with concrete foundations. The monitor space above the coal bunker is equipped with passageways and ladders so that the buckets and their driving machinery can be inspected at any point. The windows are of wired glass and artificial lighting is provided by incandescent lamps attached to fixtures in the wall, the wiring being run in armored conduit to protect it mechanically and avoid fire risk. Angle-iron buckets attached to the roof and overhead bunker trusses support the rails upon which the buckets run. The driving motor for the conveyor system is located in the coal pocket monitor. This is a 10-hp, 550-volt General Electric induction machine.

The bunker has a capacity of 390 tons, and it is of U-section, the steel plates which compose it being anchored into the steel framing of the power house by riveted members. Nearly three weeks' supply of coal can be stored in this bunker. The power house roof is a tile, tar and plastic slate construction supported on steel trusses. A large monitor is provided over the engine room. The Jas. E. Brooks Company, of New York, were the engineers for the steel work.

From the bunker spouts lead downward into hoppers equipped for weighing the coal before it is discharged to the boiler grates. The boilers are all equipped with Roney stokers, two Westinghouse engines being provided for the stoker driving. The scale beams of the weighing mechanism are located against the wall near the floor level to facilitate the recording of the coal consumption by the firemen. Coal records for each boiler, kept on Manila blanks 3½ in. x 5¾ in. are turned in regularly to the chief engineer. Fig. 3 shows the weighing hoppers, chutes, stokers and boilers in the Malden plant. Part of the floor in front of the boiler furnaces has been cut away to facilitate the removal of ashes by wheelbarrows. The ashes are weighed, and on a recent day's run amounted to 4000 lbs. out of a total coal consumption of 35,059 lbs.

There are at present four Aultman and Taylor water-tube boilers in the plant. Three of these are rated at 400 hp each, the fourth being a 650-hp unit. Each of the smaller boilers has 4000 sq. ft. of heating surface, 80 sq. ft. of grate surface and 192 4-in. tubes. The larger unit has 6500 sq. ft. of heating surface, 294 4-in. tubes and 105 sq. ft. of grate surface. The flue gases are discharged from the boilers through a Green fuel economizer of 384 4-in. tubes 9 ft. long, aggregating 4608 sq. ft. of heating surface. The water capacity of this economizer is 23,808 lbs. and the apparatus may be by-passed directly to the stack when desired. The tube scrapers are driven by electric motors. The stack is a Custodis chimney, 153 ft. high and 8 ft. inside diameter. It replaced two iron stacks in the original plant, 90 ft. high and 4 ft. inside diameter. A ladder is pro



FIGS. 4 AND 5.—TWO VIEWS OF ENGINE ROOM OF MALDEN PLANT.

vided outside the stack for inspection and repair purposes.

Three feed pumps are located in the pump room. There are two closed heaters in the plant, one a Goubert 600-hp outfit and the other a 1000-hp National. City water is used for steam supply, the meter being located in the boiler room. The usual temperature of the water entering the primary piping at this season of the year is about 40 degrees F.; this is raised to 202 degrees at the entrance of the secondary heater, to 210 at the economizer and to about 250 degrees at the boilers.

An American draft gauge is in constant service in this plant, with an Arndt carbon-dioxide recorder and a Bristol recording flue thermometer. The firemen are instructed to keep the percentage of CO_2 as high as is feasible, 10 per cent being the minimum allowed. The carbon dioxide recorder has been a definite help in the saving of coal since it was installed. The temperature of the flue gases entering the economizer varies somewhat with the load upon the plant. Upon a recent day it was 420, 440 and 380 degrees F. at 1 a. m., 9 a. m. and 5 p. m., the temperature of the gases leaving the economizer being at these times 230, 230 and 245 degrees.

In addition to the chimney, the plant is equipped with the Sturtevant induced draft system; the fan 9 ft. diameter and 46 in. wide, is driven by an 8 in. x 10 in. engine. The induced draft apparatus is ordinarily operated only in the hours of peak load.

All the station piping is of extra heavy construction. Each of the three 400-hp boilers supplies live steam at 150 lbs. pressure through an 8-in. bend to a 12-in. horizontal header running longitudinally above the boilers. A 10-in. lead is used on the 650-hp boiler. At each end of the header a 12-in. line is carried through the fire wall which separates the boiler and engine rooms, into the basement of the engine room. Each line supplies two engines, all the leads being 6 in. in diameter except in the case of a 375-kw unit, which has a 5-in. steam supply.

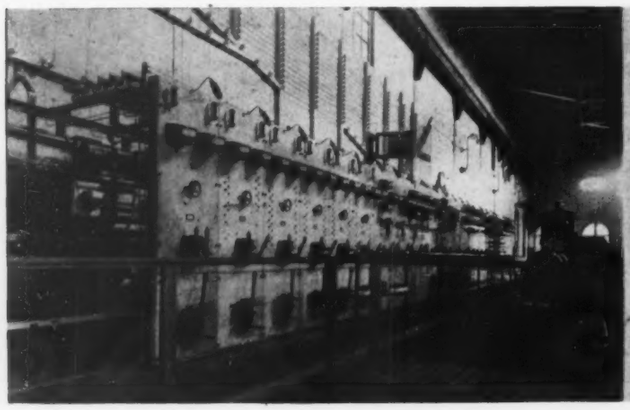
The data of the present generating units are as follows:

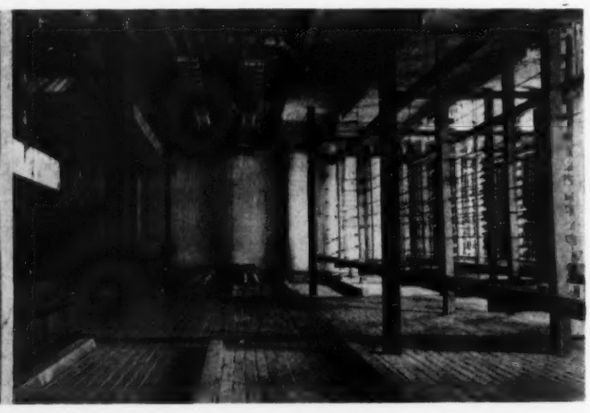
No. 1. 250-kw, 2300-volt, 60-cycle General Electric monocyclic alternator, direct driven by a 400-hp, tandem-compound, Ames engine at 200 r. p. m. No. 2. 375-kw, 2300-volt, 60-cycle, General Electric, three-phase alternator, driven by a 700-hp, Rice-Sargent, tandem-compound engine at 150 r. p. m., with a reheating receiver in the basement having 75 sq. ft. heating surface. Nos. 3 and 4. 750-kw, 2300-volt, 60-cycle General Electric, three-phase alternators direct driven at 120 r. p. m. by 1400-hp, cross-compound, Rice & Sargent engines.

Figs. 4 and 5 illustrate respectively the engine room as a whole and one of the 750-kw units at close range. The engine room is served by a hand power traveling crane of 16 tons capacity, which traverses its entire length. The engine room lighting is furnished by alternating-current arc lamps mounted on ornamental standards in the middle of the room and hung from brackets set into the side walls. A basement 9 ft. high extends beneath the engine room floor, and all the condensing equipment is set up here. Each engine is fitted with a Monarch safety stop which can be operated by push buttons in different parts of the plant. Beneath the floor near each engine is its condenser and air pump.

The exhaust piping is arranged so that any one or all of the engines can be run non-condensing if desired, and either cylinder of the 750-kw units can be operated separately upon the condenser corresponding to that unit. Circulating water is drawn from a small brook near the plant, but in order to help out at the peak loads a Boyer cooling tower installation has to be pressed into service. The fan for this cooling tower is 8 ft. in diameter and 7 ft. 10 in. wide. It is mounted in a small house on the west side of the plant, and driven by a 10-in. x 10-in. Exeter engine. The height of the tower is 33 ft. 8 in., and water is pumped into this from the hot well by a Warren duplex circulating pump. The water tank of the cooling tower is 22 ft. square at the bottom, and its capacity is 14,500 gals. There are 20,600 sq. ft. of cooling surface in the tower.

Three exciters supply the field current at present. There are a six-pole, 50-kw, 400 r. p. m., 125-volt generator direct-driven by a General Electric 9½-in. x 15-in. x 6-in. vertical marine-type compound engine, and two Westinghouse 30-kw, 125-volt exciters, each being direct-connected to a 40-hp, 220-volt, three-phase induction motor making 850 r. p. m. The motor-driven exciters are operated in preference to the steam-driven unit, although the latter helps out in the hours of peak load.





Figs. 6 and 7.—Switchboard and Interior of Wire Tower, Malden Plant.

The switchboard is 65 ft. long and is composed of 26 light marble panels grouped as follows, from left to right, Fig. 6: Auditorium lighting service (a large theater in Malden); two 2300-volt commercial lighting panels for Malden; Medford commercial lighting, 2300 volts; Melrose and Wakefield day load, commercial lighting; Everett commercial lighting, 2300 volt; four generator panels; the line panel connecting with the suburban station of the Revere Gas & Electric Company, four miles distant; panel controlling three exciters; panel containing Tirrell regulator and controlling two motor generator sets; panel containing oil switch for locking the two sets of three-phase buses together; Malden three-phase power panel; Medford and Melrose power panel; Everett power panel; spare power panel controlling economizer motor; three municipal incandescent panels and four 6.6 ampere alternating-current arc panels. The outgoing lines are equipped with automatic oil switches, but the generator switches are of the hand-controlled type. Watt-hour meters, potential transformers, etc., are mounted behind the switchboard on a special angle iron framework, with wide clearance to facilitate passage between the board and the wall.

Fig. 7 shows the interior of the wire tower with the lightning arrester equipment and outgoing feeders. The minimum complication in wiring is noticeable. Great care is observed throughout the plant to protect it from fire risk, chemical extinguishers, sand pails and bellows being available for immediate service. A valuable bit of tabulated data on the telephone booth consists of

the names, telephone calls and addresses of the physicians who are first to be called in case an accident occurs. All windows exposed to fire risk from adjacent structures are fitted with metal shutters.

A careful record of the output of the plant is kept on daily log sheets, one of which is reproduced herewith in reduced size. The original is a blank 16½ ins. x 19¾ ins., and it shows at a glance the complete performance of the plant for 24 hours, beginning at 1 a. m. each day. On this blank the total station load curve in average outputs from hour to hour is plotted in diagram form. The hours of the day are laid out as abscissæ, and full lines are drawn during the period when each machine is in operation, opposite the space awarded to that machine. Gaps show when the machine was shut down. Dotted lines are used to show when the boilers are banked. In the same way, full lines show when each feeder circuit is in service, and the hours of employees are thus recorded. Over-lapping service of any kind can be seen at a glance. Thus, the firemen lay off between 12 and 1 p. m., the Roney stokers taking care of the load, and between 3:15 and 6 p. m. two engineers handled the station times the average and 8.35 times the minimum. The charts are made comprehensive enough to cover the needs of all the plants controlled by the syndicate, whose headquarters is at 84 State Street, Boston, Mass. Messrs. Tenney, Royce and Bradley are the chief executive officers, as in the case of the Haverhill Electric Company, whose plant was described in these columns March 16. Mr. A. E. Bliss is local manager at Malden, Mr. F. C. Sargent being electrical engineer of all the properties. The chief engineer of the Malden power station is Mr. G. R. Wood.

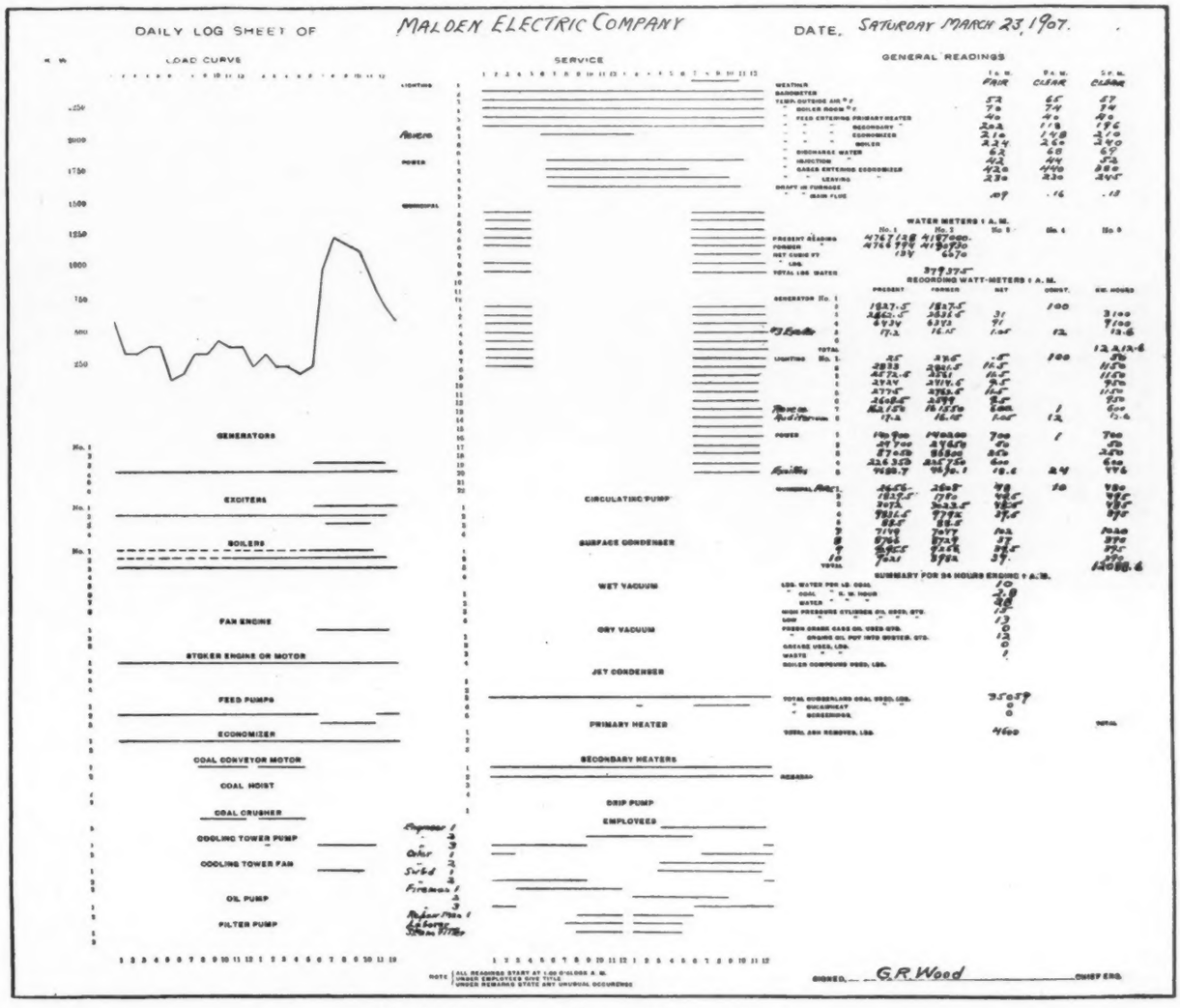


Fig. 8.—Log Sheet, Malden Electric Plant.

on the day indicated. Weather, barometer, temperature and draft records are provided for on the sheet, together with watt-hour meter readings and a summary for the 24 hours covered.

On Saturday, March 23, the plant produced a kw-hour on 2.8 lbs. of coal, the total fuel consumption being 35,059 lbs. The total output at the generators was 12,212 kw-hours, the average load being 510 kw. The maximum load was 1250 kw or 2.45

Asbestos Wood.

By Prof. Charles L. Norton.

Asbestos has been widely used of late in the electrical arts as a basis for insulations which must withstand somewhat elevated temperatures, and also as a fibrous binder for a great number of so called "compositions" and molded insulators. It is a fiber, practically the only one, which is of a refractory nature, and it is an electrical insulator of a high order. Further, asbestos is not affected chemically by many of the active chemical agents likely to attack most insulations.

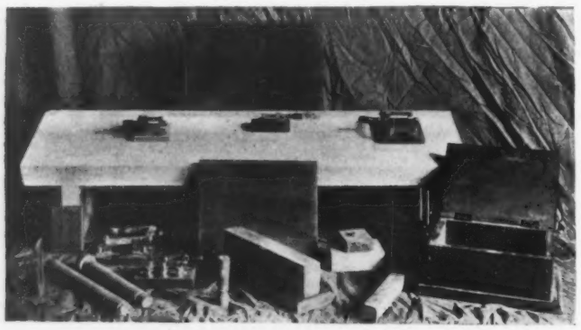
When the rock in which the veins of asbestos occur is blasted out, usually in open quarries, the thick veins containing the long fibers are broken out with hammers. These masses or clusters of long fibers are known as "crude" asbestos and are broken up

and combed and carded and spun much as cotton is, giving us yarn and string and cloth. The remainder of the rock, carrying much larger quantities of shorter fiber, is sent to a mill and is ground and sifted until out of these dark and solid-looking rocks there come large quantities of fluffy white fibers sorted into different lengths. The longer of these mill fibers find use in asbestos paper and cardboard, while the shorter are used as fillers for paper and rubber and similar fabrics. Until recently, however, the very short fibers and "sand" have constituted the waste of the process, and have had no commercial value.

Within a short time, however, as the result of the joint efforts of Mr. Henry M. Whitney, of Boston, who controls the larger part of the asbestos mines at Thetford and Black Lake, in the Province of Quebec, and of the writer, who has been experimenting upon refractory materials for several years, it has been found possible to construct from this very short fiber a non-inflammable, electric insulating material which is unique in some of its physical characteristics. We have given it the name "Asbestos Wood," since, although composed almost wholly of asbestos, it possesses many of the qualities of wood and can be worked as wood is worked.

Asbestos wood has somewhat the appearance of soapstone, but it is much harder and lighter. In comparison with wood it is from 60 to 70 per cent heavier than oak, and its strength, as shown by tests of pieces as large as 48 ins. in span subjected to center loads, is approximately 75 per cent that of white pine. While pine weighs from 2½ to 3½ lbs per square foot, 1-in. thick, and oak from 4 to 5 lbs, the asbestos wood weighs between 7 and 8 lbs., and slate or marble weigh very nearly 14 lbs for the same thickness.

Its electrical properties have been the subject of some study by Prof. F. A. Laws, of the Massachusetts Institute of Technology, and a detailed report will be made of his investigations



ARTICLES MADE OF ASBESTOS WOOD.

at an early date. Insulation tests made between electrodes three inches in diameter show that when dry the asbestos wood has a resistance of about 5000 to 6000 megohms for five-eighths and three-quarter inch thicknesses. Being more porous than slate or marble, it is necessary in many instances to impregnate the asbestos wood in order to make it impervious to moisture. The writer has found that certain excellent insulating materials can be made to penetrate the pores of the wood, even to the center of pieces 2 ins. thick, and then caused to harden. This raises the insulation resistance to 1,000,000 megohms in the case of a piece ⅝-in. thick tested with 3-in. electrodes. The puncturing voltage, rapidly applied, of the saturated material, is in the neighborhood of 45,000 volts, while pieces 1½ ins. thick stood 56,000 volts successfully. It will be seen that these figures place the new material when impregnated in the same class with the best marble, and when reasonably dry, though not impregnated, in the class with slate.

Asbestos wood is not nearly so brittle as slate or marble and withstands both shocks and local overheating much better, while an arc on its surface confines its action to the spot at which it strikes and causes no cracking. The slag formed appears to be a sufficiently good insulator to cause little trouble in prolonging the arc. Furthermore, unlike some insulating materials, the asbestos wood becomes only very slightly softened or distorted by heating, or by heat and moisture, the only result of prolonged heating being to drive out gradually the impregnating compound leaving the refractory skeleton of the raw wood. Several samples which have been soaking in transformer oil for five months are apparently unaffected.

While it is possible to mold the material in almost any shape, it will probably be found cheapest in many instances to cut it into shape, since it can be worked readily with ordinary woodworking tools. The band saw, buzz saw, buzz planer, jointer, molder, sanding machine, all work the new material much as they do hard wood, and with about the same speed. Most tools have to be sharpened after cutting about two-thirds as much asbestos wood as they would cut of oak without resharpening.

For switch panels, switch bases, instrument backs, small distributing panels, rheostat tops, electric heater insulations, protection of woodwork from wiring, etc., it would seem that the new material should give good service. Its lesser susceptibility to shocks, its lightness, its readiness of fitting and boring and its higher insulation when impregnated, should make it available with advantage for much for which slate is now used.

The raw wood itself will, I believe, find a field of usefulness as a fire-retardent for such purposes as those for which fireproof wood and metal-covered wood are widely used. Doors, especially fire doors, trim, sash, moldings and furniture, have been made of it and appear to be well suited to withstand the structural duties imposed upon them, and they are very enduring under fire. They take paint and varnish well and seem to be much less sensitive to changes in heat or moisture than ordinary wood. The impregnated material, it should be noted, is more than twice as strong as the raw wood, and it can be worked in practically the same way.

Both machine screws and ordinary wood screws can be made to hold well in both the raw asbestos wood and the impregnated material. Wood screws hold twice as strongly in the raw wood as in white pine, and in the impregnated material from three to four times as strongly as in pine.

Electric Distribution Systems.

In a paper read last week before the Convention of the Iowa Electrical Association, Prof. A. H. Ford, of the State University of Iowa, discussed the selection and design of a distributing system from the standpoint of cost and operating characteristics. The first part of the paper deals with the general principles of line loss as related to voltage, resistance, inductance and the effect on regulation, and the various systems of distribution are then taken up.

The systems in use at present are the two and three-wire for direct currents and single-phase alternating currents, and three and four-wire, for two-phase and three-phase alternating currents. These systems may be designed from either of two standpoints—the maximum potential which exists between any two conductors or the minimum potential which can be obtained from the system. The maximum allowable potential is determined by the insulation of the line, which presents no great difficulties if the potential is not over 5000 volts. The minimum potential obtainable from the system is determined by the maximum potential for which receiving devices can be built, which is about 2200 volts for small transformers and 230 volts for incandescent lamps. The conditions of economy demand, therefore, that the line potential shall approach as near as possible to 5000 volts and still be able to get the lower potential required by the receiving devices. The line connections and relative weight of conductors for equal loss of power on the basis of equal maximum potentials and equal minimum potentials are shown in the accompanying table.

The relative weight of conductors for the same maximum potential is given merely to show the difference in the results obtained by the two methods of calculation; for the limitation of receiver potential always keeps the maximum potential below that for which it is possible to insulate the line, no matter which of these systems is chosen.

In this table the value 50 under the maximum potential for the two-wire system refers to direct-current operation. It will be recalled that for the same effective value of e. m. f. the maximum alternating voltage is $\sqrt{2}$ times the direct, and hence on the basis of the maximum e. m. f. only 50 per cent as much copper will be required for the latter as for the former.

SINGLE-PHASE ALTERNATING-CURRENT AND DIRECT-CURRENT SYSTEMS.

The great economy in conductors leads one to use the three-wire system instead of the two-wire system for low-potential circuits except where a very small amount of power is to be transmitted, or the receiver potential is greater than 250 volts. The distance to which power can be transmitted with the same loss, receiver potential and weight of conductor, is increased 63 per cent by the use of a three-wire system with the neutral of the same size as the outside conductors. The increased distance to which power can be transmitted from a transformer with a three-wire secondary as compared with one having a two-wire secondary and the same receiver potential, frequently makes it possible to connect all the customers in a couple of blocks, in a residence district, to one transformer, with a reduction in the transformer capacity to less than half what it would be if each customer were supplied with a separate transformer. This statement has been made so often that it may seem unnecessary to some; but it is not uncommon at the present day to see several small transformers placed within a couple of hundred feet. It is advisable to interconnect the secondary circuits of adjacent transformers so that they will aid each other when the maximum load does not come on both at the same time. When this is done the secondary of each transformer should be fused.

The same theoretical considerations would lead one to use the three-wire system on the primary circuits also; but it is not done on account of the extra complication which it would require at the power station, the same result being more easily accomplished by running the two-wire system at a higher potential. When the line potential is 2300 volts the size of many of the conductors is determined, not by electrical considerations, but by the strength of the wire, it not being advisable to use wire smaller than No. 8 gauge.

The low-potential at which direct current circuits must be run limits their use to districts where the load is very much concentrated.

It is desirable that the load be equally divided between the two sides of the system at all times, for the regulation of each side is dependent on the load on the other. If the two sides were equally loaded and the load should be thrown off one side, the potential on the other side would fall an amount equal to the difference between the generator potential and the receiver potential when the load was equal on the two sides, and rise twice this amount on the side from which the load was removed. The load is usually kept balanced within 10 per cent, which is accomplished by wiring each customer's premises on the three-wire system and distributing the load as equally as possible.

TWO-PHASE ALTERNATING-CURRENT SYSTEMS.

The two-phase, four-wire system may be regarded as two single-phase, two-wire systems, as far as the lighting load is concerned, two-phase feeders being required only where it is desirable to operate polyphase motors. The lighting feeders are frequently run from the power station as entirely independent single-phase circuits. The circuits will be dependent upon each other to the same extent as if run from a single-phase system, this dependence of their regulation depending on the regulation of the generators.

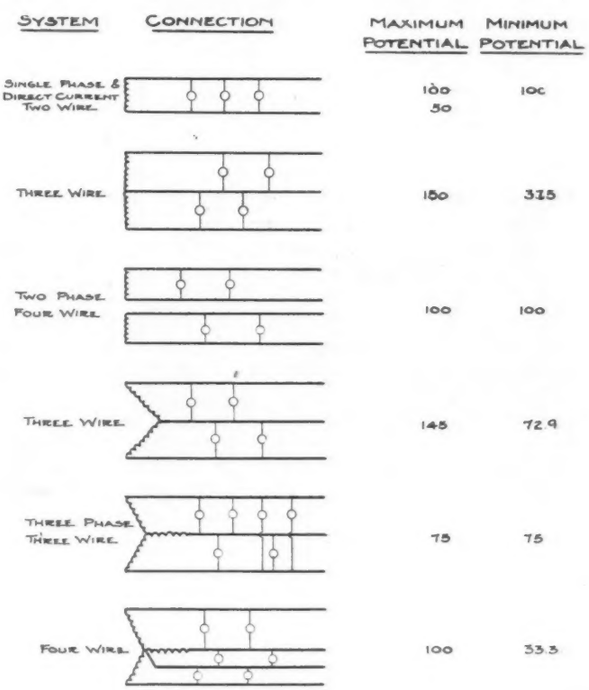
The three-wire system requires much less weight of conductor, but this saving is at the expense of the regulation, which is dependent on the drop in the common conductor in much the same way that the regulation of a single-phase, three-wire system is dependent on the drop in the neutral. The dependence is greater in this case for the current in the common conductor is 1.41 times that in each of the outsides when the load is balanced, instead of being zero as is the case in the single-phase system. A considerable saving can be effected by running the three-wire feeders to the center of distribution and running single-phase feeders from there. The three-wire system also unbalances the mechanical load on the cross-arms unless a six-pin arm is used, each arm carrying two circuits of the same size, with the common conductor of the odd circuit mounted on the top of the pole.

No matter which two-phase system is used, it is advisable to have the load balanced between the two phases at all times. This requires that care be used in connecting supply circuits so as to get customers of the same class balanced on the two phases.

THREE-PHASE ALTERNATING-CURRENT SYSTEMS.

The three-phase three-wire system requires practically the same weight of conductor as the two-phase three-wire system and with a corresponding dependence of the regulation of the potential of each phase on the load on the other phases, the dependence being greater in this case. The problem of balancing the load is greater, as it must be balanced among three phases. It is not necessary to carry more than two conductors to places where there are no polyphase motors.

The three-phase four-wire system makes use of a neutral conductor which serves the same purpose as the neutral of the single-phase system and carries no current as long as the load is balanced among the phases. The line potential is 1.73 times that of the three-wire system, which accounts for the decrease in the weight of the conductors. It is the cheapest system to install of those given, and is largely used in factories where the load consists principally of polyphase motors, for, by using 115-volt lamps and 200-volt motors, the advantages of a high motor potential can be obtained without the use of transformers for the lamp load. In some cases 230-volt lamps are used with 400-volt motors, for the saving in the cost of the conductor system more than makes up for the lower efficiency of the lamps. The same system may be used for the primary distribution circuits without introducing much more complication than the three-wire system requires.



RELATIVE WEIGHT OF COPPER.

As a motor load is very desirable, it is necessary to discuss the various distribution systems with reference to their availability for such loads. The direct-current motor is the only one which can be run satisfactorily as a variable speed machine, and, therefore, is an absolute essential for much motor work. The possi-

bilities of developing a motor load of this kind are so great in many places as to determine the choice of a direct-current three-wire system at a great increase in the cost of the distribution system over that for an alternating-current system. Where such an expense is not warranted by the motor load alone, it may be, by giving the possibility of installing storage batteries to act as insurance against shut-down and help the generators out on the peak load.

Where storage batteries are to be utilized, it is advisable to put them at the sub-centers of distribution and not at the power station. The use of the storage battery as a means for improving the regulation and reducing the cost of the distributing system has been much neglected except by the largest stations. Where the installation of a 230-volt three-wire system is not warranted, a direct-current motor load may be obtained by the use of a 500-volt circuit for power purposes only. This requires the use of special machinery in the station and a special distributing system, and this is not often resorted to. Where a motor load can be developed in a small district some distance from the power station, it may be advisable to install a motor-generator set, if arrangements can be made for its care by some customer who operates a large number of motors and on whose premises it is located.

Where alternating-current generators are used it is advisable to use polyphase machines on account of their greater output per unit cost and the possibility of running large motors from them. Self-starting single-phase motors are built as large as 25 hp, but they take such a large starting current that their starting has a very detrimental effect on the regulation of the line; it is, therefore, not advisable to use them in sizes larger than 10 hp. Induction motors are very satisfactory as long as variable speed is not required.

Two-phase distributing systems have an advantage over three-phase systems in that the load is required to be balanced between two phases instead of among three. This balancing does not have to be done very accurately if each phase of every feeder is provided with a potential regulator, and this not a point of great moment. Three-phase motors require three service wires and three transformers, while two-phase motors require four service wires and two transformers. It is possible to run three-phase motors from two transformers, but this is not done except for very small motors, on account of requiring the installation of transformers of twice the capacity of each of the three transformers. The total transformer capacity will, therefore, be 1.33 times what it would be where three transformers are used for each motor. There is practically no difference in the electrical characteristics, such as efficiency, torque, slip, etc., of two and three-phase motors.

The three-phase four-wire system requires the least weight of conductor and has the highest potential between conductors; this is somewhat of a disadvantage, for it is almost a necessity to work on the distributing system while it is alive. This system requires special generators and oil switches at the power station when the potential is 2300 volts. The generators are special only as to the potential, which must be 4000 volts, and an extra conductor connecting to the center of the Y-connected armature.

The writer is of the opinion that when the load is concentrated within approximately half a mile of the power station and there is the possibility of a considerable variable-speed motor load being developed, it is advisable to install a direct-current three-wire system with a potential of 115 volts on each side. By increasing the potential to 230 volts, a great saving in conductors is accomplished, but this is offset by lower lamp efficiency and increased trouble with cut-outs, switches, etc., on customers' premises. When the load is scattered, a polyphase system should be installed—two-phase four-wire for plants under 1500-kw capacity and three-phase four-wire for plants larger than this. The transformer potential is preferably 2200 volts primary, with a three-wire secondary having 110 volts on each side. The secondaries of all lighting transformers on each phase and feeder should be interconnected where it can be done without extending the circuit more than 200 ft. Separate transformers should be used for the motor load, though each motor need not under every condition be supplied with a separate set of transformers.

Convention of Iowa Electrical Association.

The seventh annual convention of the Iowa Electrical Association was held at Lafayette Inn, Clinton, Ia., April 18 and 19, 1907. The first session was called to order Thursday morning President Zahm then read the president's address.

After referring briefly to the good work of the officers the past year in increasing interest in theassociation he stated that the greatest menace to the industry is ill-advised, injurious legislation and municipal-ownership agitation. He thought that regulation by a state commission was inevitable; and in view of this fact and the necessity it would bring of making yearly reports to such a commission, he recommended study by the members of a standard form of accounting.

The form of accounting adopted several years ago by the National Electric Light Association was recommended, and in order that the members might be more familiar with this, the secretary had procured a number of copies of this standard form for distribution among the members. He called attention to the new incandescent lamps such as the Gem, the tantalum, the tungsten and the helion which promised to put electric lighting on a different basis from formerly. It is now definitely established that central-station business can be materially increased by vim and vigor in going after new business. The importance of the work of the executive committee to the associations made it advisable to have that committee meet twice a year, and an appropriation should be made to cover the expenses of such meetings.

After hearing the reports of the secretary and the executive committee, a nominating committee was elected by ballot, as follows: W. J. Greene, Cedar Rapids; Austin Burt, Waterloo; A. L. Dodd, Charles City; F. J. Hanlon, Mason City and P. P. Crafts, Clinton.

Prof. P. B. Spinney, of Ames, secretary of the association, then presented a paper on the statistics he had compiled from various central stations of the state on the costs of various items of operation per dollar of income. A summary of these results is published elsewhere and gives an interesting insight into what percentage the various items of operating expense are of the gross earnings. The operating expenses averaged 70 per cent of the gross income.

Mr. Austin Burt, of Waterloo, drew the conclusion from these figures that if the investment is as ordinarily considered five times the gross receipt in a central station property, these properties are earning about 6 per cent net on the investment, taking the average of the figures given.

Mr. Mathes, of Dubuque, emphasized the need of more uniform accounting. He thought it probable that an electric light commission would be established in Iowa and companies would then be obliged to keep fairly uniform records. He thought it important that the paper profits should not be taken as the actual cash profits, as is done in many cases by leaving out of account depreciation. By thus leaving depreciation out of account the public is led to suppose that there is much more profit in electric light companies than is actually the case. The companies reporting showed only an average of 1.6 per cent of their gross income devoted to advertising. He thought this was too small. Large conservative companies had found that it was safe and advisable to spend as much as 5 per cent in getting new business.

This discussion was followed by a paper by Mr. Gus Lundgren, of Cherokee, on "Central-Station Economies." Mr. Lundgren kept the convention in an uproar much of the time during the delivery of his paper by his witty way of showing the short-sighted neglect of details practiced by so many small

central-station companies. An abstract of Mr. Lundgren's paper will appear in a later issue.

Thursday afternoon Mr. E. L. Callahan, of the General Electric Company, read a paper on "Increasing the Central-Station Day Load" which dealt with the introduction of heating devices and presented data, most of which has heretofore appeared in the ELECTRICAL WORLD. The discussion on this important subject, which was one of the leading features of the convention, will appear in a later issue.

Mr. Rufus E. Lee, of Clarinda, presented a paper on the "Manufacture of Ice by Central Stations," which gave actual data on results obtained at Clarinda and was therefore of considerable value. The paper was decidedly favorable to the establishment of an ice-making business by a central-station company in the latitude of southern Iowa. An abstract of this paper will appear in a following issue. President Zahm said that his company was furnishing power to drive refrigerating machinery of Armour & Company, Mason City, and also live steam for the same company. It also furnished a public cold storage warehouse with power. He considered refrigerating machinery the very best kind of load for a central station and advised all companies to investigate it.

Mr. Frank N. Jewett, of Chicago, suggested that it was not necessary to sell artificial ice at the same price as natural ice. He knew of no case where artificial ice would not bring a better price than natural ice. Some allowance should be made for that when figuring on an ice plant.

A letter was read from Mr. J. Robert Crouse, of the Co-operative Electrical Development Association, regretting that he could not be present in the interests of that association, because he was busy with the work of getting up the commercial program for the National Electric Light Association in June. He said that 46 manufacturers had recently subscribed $143,000 to the Co-operative Electrical Development Association movement. He asked that the Iowa Electrical Association appoint a co-operating committee to represent the Iowa association along with the committees appointed by other state associations. The appointing of a committee in accordance with this suggestion was delegated to the executive committee.

Mr. Henry Longnecker, of Centerville, was asked to give his experience with the water-softening plant which he had recently put in. This plant was found to make a considerable saving in fuel and boiler repairs.

It was announced that Mr. Frank McMasters, of Chicago, who was on the program for a paper entitled "Nernst Lamps for Street Lighting," was seriously ill, having completely broken down in health and would not be able to present his paper. Resolutions of sympathy were passed for Mr. McMasters.

Friday morning Prof. G. W. Bissell, of Ames, read a paper on "Gas Producer Engines." The first part of his paper was a summary of some of the facts derived from Bulletin 261 of the U. S. Geological Survey report giving results of gas engine tests at the government testing station at St. Louis. The rest of the paper gave results of tests made by him at Algona, Ia., on a 150-hp gas engine. The results of these latter tests will be given in a later issue.

The paper by Mr. H. E. Chase on the "Proper Selection of Steam Engines" was read by its author. An abstract of this paper and the discussion upon it will appear in a later issue.

Prof. Ford, of Iowa City, read a paper on "Electric Distributing Systems," showing some of the relative advantages of single-phase, two-phase, three-phase three-wire and three-phase four-wire alternating-current distributing systems. An abstract of this paper appears elsewhere. The principal points of discussion raised on this paper were as to the use of two versus three transformers for supplying small three-phase motors and the relative efficiency of 220-volt incandescent lamps. Mr. Burt said that his company's practice was to put in two transformers at first on a three-phase motor and as the load grew to install the third transformer. As to 220-volt lamps, Mr. J. R. Cravath pointed out that all of the new high-efficiency incandescent lamps were only made for 110 volts and it was possible but not probable that they would soon be made for the higher voltages. This was a practical point against the 220-volt distributing system.

Mr. C. H. Davis, of Chicago, acting in place of Mr. McMasters, described the Nernst street lamp, which is a 50-cp unit and about the equivalent of the Welsbach street lamp. It is equipped with a vertical glower so as to give good horizontal distribution of light and is operated in any arc lamp circuit by means of a series transformer. For suburban streets a distance of 150 ft. apart was suggested for these lamps. With such an arrangement the minimum illumination between lamps would be twice that obtained from arc lamps using the same amount of power per mile of street.

In the discussion of this paper Mr. Burt favored the simple series incandescent lamp with Gem filament and with an automatic film cut-out to short-circuit the lamp when burned out. There are a number of 32-cp 6.6-ampere Gem lamps in use at Cedar Falls on series circuits. The simplicity and low first cost of the incandescent system, the absence of transformers to be burned out by lightning, together with the fact that the tendency is toward still higher efficiency incandescent lamps, made such a system best.

Friday afternoon a paper was read by Charles A. Parker, secretary of the Curtis Advertising Company, of Detroit, entitled "Modern Methods of Securing New Business." This was written in Mr. Parker's characteristic style, and was along the lines of similar papers presented by him at previous state conventions. It emphasized the necessity for making easy the way for personal solicitation by direct, by mail advertising and illustrated the point with an appropriate story about a central station man who was visited by Mr. Parker, who did not believe in advertising, but in solicitation. When asked why it was that he gave Mr. Parker audience he unconsciously admitted that it was because he had been solicited by mail so many times before the visit.

Mr. Burt said it was well established that "new business" of the right kind did more to reduce the percentage of operating expenses to gross income than any other economy that could be worked by the station. At Waterloo it had been found that a quick, hot campaign had given the best results. For a number of years the gas and electric company had solicited business in a steady, easy-going way and had only 200 gas stoves in use. By a vigorous campaign 1500 stoves had been placed in two years. On the whole, he thought direct solicitation more effective than advertising. Mr. Carson thought that advertising had its place and President Zahm said that his company always enclosed with bills some advertising matter and it brought results. For example, when the tantalum lamp was first brought out, circulars on this lamp enclosed with the bills one month sold 100 such lamps in small lots the first day after the circulars were sent out.

The convention then went into executive session, during which session the following officers for the ensuing year were elected: President, Mr. George S. Carson, of Iowa City; vice-president, Mr. L. D. Mathes, of Dubuque; secretary, Mr. W. N. Keiser, of Des Moines; treasurer, Mr. W. A. Mall, Belle Plaine. Executive committee: The officers; Messrs. P. B. Sawyer, of Des Moines; A. L. Todd, of Charles City and Gus Lundgren, of Cherokee. A co-operative committee is to be appointed by the executive committee. The membership applications were received and acted upon from the central stations at Fort Dodge, Parkersburg, Oskaloosa, Emmetsburg, Muscatine and Keokuk.

The local committee presided over by Mr. P. P. Crafts, of Clinton, thoroughly made good its promise of the year previous to take care of the convention properly if it came to Clinton. Many members visited the new steam turbine plant of the I. & I. Railway south of Clinton. A Dutch lunch and smoker was given in the hotel dining room Friday evening. Good space for exhibits was obtainable in the basement of the hotel. One hundred central station men were in attendance, as shown by the register.

New Telephone Patents.

PARTY-LINE RINGING SYSTEMS.

The step-by-step and similar mechanical selectors for party-lines have formed a fruitful field for patents for many years; the fact, however, that very few if any of such systems are in successful operation to-day has shown how futile thus far have been the efforts. The one great demand is simplicity and reliability. These attributes are essential, because of the large territory over which the mechanism must be distributed and the correspondingly high cost of adjustment. It may be that some day the proper principle or combination will be discovered, and therefore it is interesting to follow the new steps. Among the present efforts is a special device patented by A. R. Piehn, of Alta Vista, Ia., designed not only to prevent eavesdropping, but also to prevent false charging of tolls. In order to cut in on the line a button must be pressed, and this is so connected to a motor mechanism that the code signal of the station is sent down the line. Central can thus tell the particular calling station without assistance, and if any one is using the line, he is apprised of the presence of the extra station.

A. A. Monson, of St. Paul, has arranged his outlying stations on individual lines up to some common point where they are connected to a common switching device with an associated trunk line to central. The selection in toward central is accomplished by a push-button and electromagnets at the switch point. Having reached central over the trunk line, no one else may come in on the line, as all are maintained cut off from their switching mechanisms. Now if a party of the same group is desired, the operator calls the proper line through an auxiliary step-by-step selector. Similarly for a call from another line, the step-by-step mechanism is brought into use.

A patent granted to S. H. Couch, of Boston, relates to a release for a selector. This is a stop device which serves as a lock on the selecting mechanism. The stop is in the form of a lever which becomes tripped by the descending receiver hook. It is thus impossible to leave the mechanisms set out of normal, as the returning mechanism of the called station may reset all stations to normal.

A system invented by H. J. Fisher, of Hotchkiss, Calif., provides for all switching to be done by the operator. One desiring a connection rings the operator and she applies such currents as may be necessary to effect selection. The apparatus has a mechanical locking feature whereby no battery currents need be maintained on the line save during the actual switching processes.

Finally, we have a system invented by Messrs. C. L. and T. P. Carr, of Yellow Springs, Ohio. This provides besides the usual mechanisms and features, means for resynchronizing all the selectors at will, a busy signal, and means for calling central irrespective of the position in which the selectors may have been left.

NEW APPARATUS.

J. A. Birsfield, of Rochester, N. Y., has obtained a patent for a gang ringing key for selective use. This is of the usual appearance, but carries a slide bar which is shifted momentarily

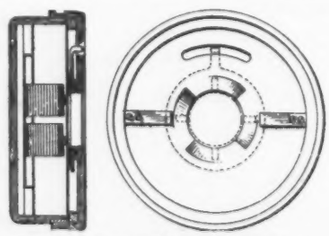


FIG. 1.—TURNER RECEIVER.

during the depression of any plunger. This slide bar has a perforation for each plunger, but this is normally out of line. The plunger carries a shoulder which locks under the bar, whereby the plunger is locked down until the bar is disturbed by the depression of a second plunger. The plunger key wedges have a flare at the bottoms so that in snapping back they cushion against the switching springs. The patent for this key is assigned to the Stromberg-Carlson Company.

K. M. Turner, of New York City, is the inventor of the adjustable receiver shown in Fig. 1. This receiver is for use with the acousticon, a telephonic system for the partly deaf, and to adjust its sensitivness a pad is arranged to press on the diaphragm. This pad is mounted upon a stiff frame, which rides in niches in the receiver cap. These niches vary in depth so that the pressure of the pad on the diaphragm may be varied at will.

NEW TRUNK CIRCUITS.

Trunk circuits for two-wire central energy systems are still being patented in considerable numbers. These usually all provide the general one-way trunk feature, but are modified in detail to fit special conditions of the system with which to be used. H. G. Webster patents a circuit, assigned to the Kellogg Company, for operation between a Dunbar type board and one of the older types. F. W. Dunbar has a circuit for the same conditions, assigned to the same company, as well as one arranged for the Dunbar type board at each end.

INTERCOMMUNICATING SYSTEMS.

An intercommunicating system in which the signalling of a station may be done irrespective of the position of the manual switches at its own or any other station except that calling has been patented by A. K. Andriano. The bells are all tapped between a special wire and the station wire independently of the

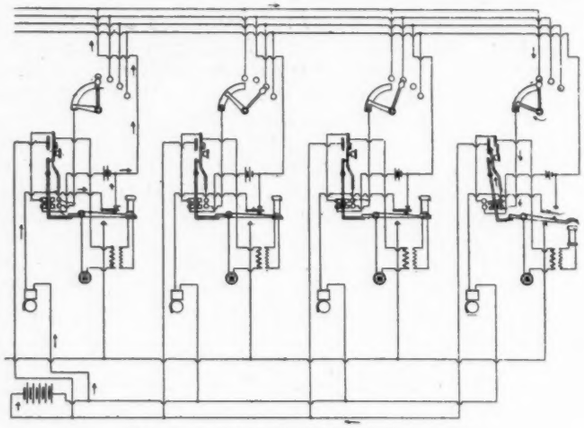


FIG. 2.—ANDRIANO TELEPHONE SYSTEM.

manual switch, as may be traced out in Fig. 2. Mr. Andriano's patent is assigned to the Direct-Line General Telephone Company.

S. A. Koltonski, of Boston, has patented a switch for intercommunicating systems with a latch device. The return of the receiver to the hook releases any depressed button. This patent is assigned to the Electric Gas Lighting Company.

Letter to the Editors.

High-Voltage Alternators.

To the Editors of Electrical World:

Sirs: Referring to the recent discussion on high-voltage generators before the American Institute of Electrical Engineers, the pioneer work in high tension generation and transmission, done by Mr. S. Z. de Ferranti in the Deptford Station of the London Electrical Supply Corporation, seems to be almost forgotten to-day. Ten years ago the Deptford Station was still talked of with wonder and respect, but in these days of large high-tension work, it has been forgotten. It will be interesting for me to quote from one of Mr. Ferranti's letters, referring to this station:

"In 1887 I made my first 10,000-volt transformer of 10 hp and

put it to work at the Grosvenor Gallery generating station in London from which we supplied a very large net-work of overhead mains at 2500 volts alternating current. The above experiment was undertaken to get some idea of the suitability of a pressure of 10,000 volts for use in transmitting current from Deptford to London and so replacing our in-town station with one at a distance.

"In 1888 I designed my first 10,000-volt generators of 1000 kw each. They were built and put to work the following year. They generated the full pressure in the machine without transformation. They have been at work for 18 years and are only now being replaced with modern machines. They ran at 180 r. p. m. and were driven with 40 ropes from Corliss engines.

"I also designed for the Deptford Station at the same time two machines of the same voltage for 10,000 hp each. These were built, but were never completed. They, together with their engines, were never erected and were broken up and sold. This seems extraordinary now, but when my connection with the company came to an end the directors were persuaded that no one would think of using machines of such size and that London could never require such units!

"Now, there is a most peculiar coincidence connected with these machines (of which I have the drawings and photos of some of the parts). *Ten years later* the first of the great stations in New York were designed and in due course installed with units of 10,000 hp. The voltage in each case (Deptford and New York) was about the same, 10,000 to 11,000 volts. The steam pressure was the same; that is, 200 lbs. per sq. in. The high pressure was used in compound engines, which was quite new in 1888. Each engine had two high-pressure cylinders and two low-pressure, and, extraordinary to say, they were in each case 44 ins. and 88 ins. in diameter. The speeds and stroke were different, mine being slower, but the piston speeds were the same.

"You will thus see that prior to the introduction of turbines Deptford formed a close model for much of the biggest work undertaken all over the world.

"The transmission from Deptford was by paper-insulated concentric tubular mains, and step-down transformers of 150 kw were used. These were arranged for a conduit for air-cooling by fan, but the fan was found unnecessary, as the air circulation by natural draft through the body of the iron and windings was found to be very good.

"The extra high-pressure machines at Deptford were always run in parallel and at times they were run in parallel with the 2500-volt generators in London through the transformers and underground cables. The switch gear was at first air break, as it was in other stations where I made use of the first oil-break switches and fuses and the cellular pattern of gear now universally adopted.

"In 1888 we had to design everything new that was required. We also had to make everything for ourselves, including alternators, mains, transformers and switch gear. Moreover, there were no satisfactory insulators in those days as now known and designs had to be made to suit their poor quality. Furthermore, there was the most complete absence of experience on all big work. To add to our difficulties, we could not, after the passing of the Electric Lighting Act in 1888, use overhead mains, and so 10,000 volts had at the very beginning to be used as an underground system."

When we remember that these 10,000-volt generators were *revolving armature* machines and were constructed and put in operation nearly 20 years ago and have been in successful operation ever since, we can realize the work that was done at Deptford and we can also realize that most of the so-called development work that has been done since, in large high-tension city work, has been quite elementary compared to the work that was done successfully at Deptford 20 years ago by Mr. Ferranti. So I think that in any historic account of the development of the high-voltage generator, we ought to give a very prominent position to Mr. Ferranti as the designer and constructor of the first large high-tension generators to be put into successful operation.

MILWAUKEE, WIS. W. L. WATERS.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Transformer Indicator Diagrams.—T. R. LYLE.—The term "transformer indicator diagram," as used by the author, relates to any diagram showing the instantaneous values of the primary and secondary currents and electromotive forces and the core flux. He remarks that none of the usual indicator diagrams enables one to determine directly and independently either the wave of magnetic flux in the core or the wave of magnetising ampere turns, usually represented by the vector sum of $n_1 I_1 + n_2 I_2$. Of course, the latter quantity can be obtained by the vector addition of $n_1 I_1$ and $n_2 I_2$, but as the latter quantities are, when the transformer carries a load, approximately equal in magnitude and opposite in phase, the vector sum is a small quantity compared with either of them and small errors in the magnitudes of the two components may cause a large percentage error in the resultant and the determination of its phase may become utterly unreliable. The author has designed a wave tracer by means of which the e. m. f. and current waves can be accurately determined and also the wave of magnetic flux pulsating in the core. In addition it is possible to obtain by its means the magnetising current wave with the same accuracy as any of the other quantities.—*Phil. Mag.*, April.

Induction Motor.—L. J. HUNT.—The first part of a paper read before the Manchester section of the (British) Institution of Electrical Engineers. The motor described in this paper possesses all the characteristics of the ordinary type of slip-ring induction motor, but differs from it in the arrangement of the windings. These are arranged to permit of the starting or regulating resistances being connected to the stator windings instead of to slip rings in the ordinary manner. The machine is an improved form of "cascade" motor, having two magnetic-field systems superimposed upon one another in the same core body. The second field has its origin in the rotor, and consequently induces secondary currents in the stator windings. In the present instalment various applications of the cascade principle are described. In the new motor the stator carries a single winding and is provided with terminals for connecting to the supply mains and with tappings which are connected in pairs through resistances while starting or when rheostatic speed control is desired, and are short-circuited at normal speed. Figures are given showing the advantages of a stator wound with a single tapped winding over a stator wound with separate primary and secondary windings.—Lond. *Elec. Eng'ing*, March 28.

Interpole Motors.—K. W. WAGNER.—Since interpole machines were introduced, oscillation phenomena have been observed in connection with them. The author discusses analytically the conditions for the stability of the operation of a direct-current shunt motor. He first neglects the reaction of the armature current on the main field, but later takes it into consideration. In the first case the operation of the motor is necessarily stable. In the second case pseudo-stable and unstable conditions of operation are possible when the main field is weakened by the action of the armature current. These cases have been observed with interpole motors. By displacing the brushes from their normal position backwards, the pseudo-stable state is first reached and oscillations take place. If the

brush is further displaced or if the shunt excitation is decreased, the unstable state is reached, the oscillations increase rapidly until finally a short-circuit occurs in accordance with the theory of the author.—*Elek. Zeit.*, March 28.

Single-Phase Commutator Motors.—F. Eichberg.—A communication replying to the last letter of Richter in their polemics concerning single-phase commutator motors of the Allgem. Elek. Ges. and of the Siemens-Schuckert Company.—*Elek. Zeit.*, March 28.

Power.

Electric Power in Shops for Printing Fabrics.—M. Arbeiter.—A strong tendency to replace steam engines by electric motors is now observed in shops for printing fabrics, cotton, etc. The chief difficutly is that a variation of speed is necessary between the limits of 1 to 7 or even 1 to 9. The author discusses the different electrical systems which may be used and concludes that direct-current shunt motors should always be installed. Even where three-phase currents are available and a conversion of the three-phase current will become necessary, it is more economical to convert the three-phase current into direct current.—*Elek. Zeit.*, March 21.

Electric Power in France.—R. Frilley.—The first part of an illustrated article on the electric supply network in the Alpes Maritimes. This network is operated by one company and is supplied with energy from three water power stations and five steam stations.—*L'Eclairage Elec.*, March 30.

Traction.

Mountain Roads.—W. A. Mueller.—An article on several new mountain roads near Interlaken in Switzerland. The first one is the Harder road which is a cable road operated by a 100-hp, 2000-volt, three-phase motor. The second is the Niesen road which is carried out in two portions. The lowest grade is 15 per cent, the highest 66 per cent, which is the maximum so far reached in any mountain road. It is a cable road, two three-phase motors being installed on the top of the mountain for the two portions. Of peculiar construction is the road to the Wetterhorn, the first part of which is soon to be opened. The car, which has a capacity of 20 passengers, does not run on rails but is suspended on two cables in the way used in telpherage systems. It is electrically hoisted by means of a cable.—*Elek. Zeit.*, March 28.

Rail Corrugation.—J. A. Panton.—A paper read before the (British) Institution of Electrical Engineers. The author shows that the trouble experienced with rail corrugations may be traced to the use of weak trucks and unsymmetrically-driven axles and that the usual theories as to the action of the corrugation are not tenable.—Lond. *Elec.*, March 22; Lond. *Elec. Eng'ing*, March 28. In the discussion which followed, H. M. Sayers thought that the use of harder rails would go far to avoid corrugation difficulties. W. W. Beaumont compared the effect to the action of a rolling mill, where somewhat similar troubles are experienced.—Lond. *Elec. Eng'ing*, March 28; Lond. *Elec.*, March 29.

Single-Phase Road.—An article on the new Hamburg-Altona single-phase road which is to be opened in the near future. This is the second alternating-current normal-gauge road in Germany. The power house is equipped with steam turbines. Each car is provided with three Winter-Eichberg single-phase motors.—*Elek. Anz.*, March 17 and 21.

Cable Way.—An illustrated description of a new cable way in a British shipbuilding works. Three-phase supply is in use and the cable way is operated by induction motors.—Lond. *Elec.*, April 5.

Installations, Systems and Appliances.

Multiple-Gap Lighting Arresters.—R. B. Ingram.—Very peculiar effects have often been observed on multigap lighting arresters, due to the unequal distribution of potential across the various gaps. There is an erratic action of such arresters when installed under conditions apparently identical; thus it has been found that arresters of the same design possess a varying minimum discharge point, the variation being due apparently to varying local conditions. To overcome this disadvantage, an adjustable spark gap has been inserted in series, on the line side of the multigap of the arresters, but this expedient has not proven entirely satisfactory for all conditions. The new device described by the author not only eliminates the disadvantages, but also another effect, namely, the observed diminution in voltage-sustaining power of the

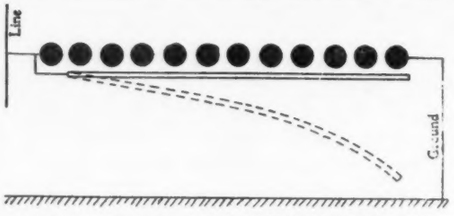


FIG. 1—MULTIPLE-GAP LIGHTNING ARRESTER.

respective spark gaps as the number of gaps is increased for high-voltage service. The voltage-sustaining power per gap unit decreases rapidly when the voltage increases from 15,000 to 75,000. Beyond this latter voltage additional gaps have little influence in increasing the voltage-sustaining power of the series. In addition to the potential across the air gaps between adjacent cylinders in a multiple-cylinder arrester there is also a strain or difference of potential between the cylinder and the ground. For a grounded circuit this latter strain is a maximum between the first cylinder on the ungrounded side and the ground. With increasing voltage there is the danger that on account of this strain the air around the first cylinders on the ungrounded side will be ionized so that some of the air-gaps at this end may not act as insulators. To remove the excessive

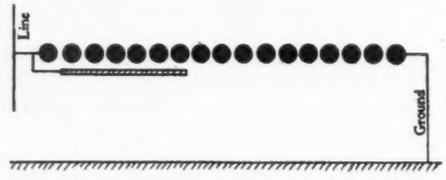


FIG. 2—MULTIPLE-GAP LIGHTNING ARRESTER.

difference of potential between the cylinders and the ground the author introduces a "ground shield" consisting of a thin metallic plate or parallel rods between the series of cylinders and the ground, in close proximity to them, well insulated from them and electrically connected to the line. The strain against the ground is thus transferred from the cylinders to the shield. The dimensions and position of the shield, however, have a great effect on the results. If the shield is shaped as shown in the drawn-out lines in Fig. 1, so as to cover all of the gaps of the series throughout the full length, there will be a strain similar to the ground strain but of opposite value, caused by the difference of potential introduced into the gaps on the ground side of the arrester and the shield. To obtain

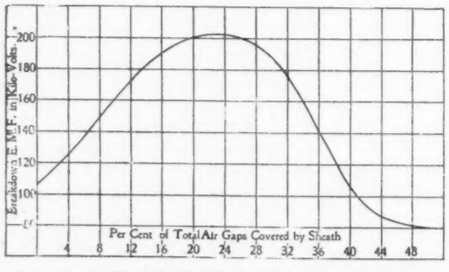


FIG. 3.—TEST CURVE OF LIGHTNING ARRESTERS.

the ideal conditions it is necessary to so shape the ground shield as to eliminate this superimposed influence on the ground gaps. A ground shield properly modified to give the desired results is shown by the dotted lines in the same illustration. However, a shield of this form would be difficult to insulate and would require more space than is practicable. A reasonably

satisfactory compromise is made by reducing the length of the shield to a proper amount and placing it in close proximity to the gaps as shown in Fig. 2. Actual tests with a series of gaps and shields of different lengths arranged in this way are represented by the curve in Fig. 3. It will be seen that a shield covering about one-fourth of the gaps will increase the break-down voltage from about 100,000 to 200,000. If the shield is made either longer or shorter, the break-down voltage is smaller. The above applies only to a series of air-gaps when one end of the series is grounded. For ungrounded conditions shields should be placed at both ends of the series to get the best results.—*Elec. Journal,* April.

Wires, Wiring and Conduits.

Sheathed Conductors.—Biske.—An illustrated description of the Kuhlo system of wiring with sheathed conductors. The characteristic of this sheathed wire is that there is no empty space between the insulation and the sheath. The sheath is made of copper, brass or iron, and is quite flexible. The system can be applied to all sizes of conductors used in interior work.—Lond. *Elec.,* April 5.

Electro-Physics and Magnetism.

Density of Ether.—Oliver Lodge.—A theoretical discussion on the density of the ether on the basis of the electronic theory. "Just as the ratio of mass to volume is small in the case of a solar system or a nebula or a cobweb, I have been driven to think that the observed mechanical density of matter is probably an excessive small fraction of the total density of the substance, or ether, contained in the space which it thus partially occupies—the substance of which it may hypothetically be held to be composed." For instance, in the case of platinum, if the atoms are composed of electrons, the space which these electrons actively "fill" as compared with the whole space which in a sense they "occupy," is comparable to 10^{-16}th of the whole, even inside each atom; and the fraction is still smaller if it reverses to the visible mass. A kind of minimum estimate of etheral density on this basis would then be something like ten-thousand-million times that of platinum. "This, standing alone, would be a wild guess." The author, however, gives his full theoretical argument in favor of such a view, and concludes with this estimate: "The ether has a magnetic inertia coefficient which can be represented by likening it to a mechanical medium with a density of 10^{12} grams per cubic cm; the intrinsic etherial kinetic energy is 10^{33} ergs per cubic cm; any streaming along magnetic lines of force is, in cm per second, one-four-millionth of the number of c. g. s. units of intensity in the magnetic field." In the second part of the paper the author gives an account of his former experimental attempt to observe the hypothetical ether flow along magnetic lines of force. The deduction from his experiment 13 years ago was that either the theory about longitudinal magnetic drift is erroneous or else the ether of space is at least eight times as dense as platinum. He now thinks it might be fifty thousand million times as dense. In this case "every cubic cm of space contains the equivalent of a thousand tons and every part of it must be internally squirming with the velocity of light."—*Phil. Mag.,* April.

Electromagnetic Theory.—A. H. Bucherer.—The author refers to the difficulties which Maxwell's theory has encountered because terrestrial optics is not influenced by the earth's motion. The present author, guided by the feeling that the form of the Maxwellian equations must correspond somehow to the true laws of electromagnetism, attempts a new interpretation of these equations that would harmonize with the facts. He develops what he calls the principle of relativity in electromagnetism.—*Phil. Mag.,* April.

Effect of High-Frequency Currents on Magnetic Hysteresis of Iron.—A. Battelli and L. Magri.—An account of an investigation in which several magnetization curves for iron and steel wire of various dimensions have been obtained by means of the Braun cathode-ray tube. Equal currents at frequencies varying from 50 to 10,000 periods per second were used to determine in what way the form and magnitude of the hysteresis curve depended on the frequency. It was found that with steel or thin iron cores, the eddy currents generated were very small, but when thick iron was used they were quite noticeable. The permeability of the iron does not depend on the frequency, when this is between 50 and 10,000, and if the influence of the Foucault currents is eliminated. The hysteresis curve shows a small reduction with the increasing frequency and any apparent increase in the curve is caused by eddy currents.—From *Proc. Acad. Lincei,* abstracted in Lond. *Elec.,* March 29.

Inductance Coefficients.—A. Russell.—His (British) Physical Society paper in full on the magnetic field and inductance coefficients of circular, cylindrical and helical currents.—*Phil. Mag.,* April.

Electrochemistry and Batteries.

Electrochemistry.—J. Izart.—The conclusion of his review of recent progress in electrochemical engineering. The author discusses lead refining and progress made in the metallurgy of antimony and tin.—*L'Ind. Elec.,* March 10.

Moissan.—R. S. Hutton and C. A. Doremus.—Two sketches, with portrait, of the life and work of the late Henri Moissan.—*Electrochem. and Met. Ind.,* April.

Electric Steel Furnaces.—J. B. C. Kershaw.—In a continuation of his illustrated serial on electric furnace methods for iron and steel production the author describes briefly the furnaces of Conley, Galbraith, Gin and Girod, without giving anything new.—Lond. *Elec.,* April 5.

Units, Measurements and Instruments.

Series Transformers.—H. B. Taylor.—A discussion of the errors which may arise by the use of series transformers in connection with instruments for alternating-current measurements, with some editorial remarks by W. H. Thompson on the same subject. The ratio of the currents in the primary and secondary of the transformer is affected by the impedance of the secondary. If the impedance in the secondary circuit is higher than that for which the transformer was designed, the current ratio is changed. For a given change, within reasonable limits, of the secondary impedance, the change of the current ratio is greater at low loads than at high loads. Naturally if the increase of the secondary impedance is carried to excess so that the core becomes saturated at high loads, the reverse will be true. But this is not likely to be a practical condition. Under ordinary conditions if the secondary impedance be increased at the low loads only, by exchanging an instrument used at the high loads for one which will give a more legible reading at the low ones, the discrepancy in ratio is likely to be large. The low reading instrument invariably has a higher impedance than the one of larger capacity and this additional impedance is introduced into the circuit while making the very measurements which will be most influenced by it. The author emphasizes this point since it is so easy to fall into the error of measuring the currents at different loads with different ammeters in the secondary circuit. For accurate measurements it is essential that the transformer be operated at approximately full-load current, and that for a series of measurements using one transformer the impedance of the secondary be kept constant. It is sometimes desirable, especially in switchboard work on high tension circuits, to employ one series transformer to operate two or three instruments. In connecting up several instruments in this way it must be remembered that each additional instrument increases the ratio error and that if any of the instruments have a particularly high impedance the readings of the whole set of instruments will be affected. If accurate measurements involving the use of switchboard instruments are to be made, as in the testing of a power station, the safest method, where several instruments are on one circuit, would be to short-circuit all instruments but one in taking readings, or to calibrate the instruments and transformer together. Another source of error is the phase displacement between the primary and secondary currents. In ordinary transformers the error is insignificant in wattmeter readings taken at 100 per cent power factor, but it may noticeably affect the measurements on circuits at lower power factor. A convenient kind of series transformer for use in testing is one without a permanent primary winding. The

core and secondary coil are arranged so that the conductor passed one or more times through a hole in the middle of the core acts as a primary. When a transformer of that description is used, the number of primary turns can be made to suit the current to be measured so that the reading of the ammeter in the secondary will be within the best part of its range.—*Electric Journal,* April.

Selenium in Photometry.—P. von Schrott.—An article in which the author discusses the possibility of employing selenium for photometric measurements. He shows that in many cases it is directly impossible to employ selenium as a substitute for the human eye for photometric purposes, because the sensitiveness of selenium and of the eye is different with respect to colors. Moreover, in those practical cases in which it is necessary to compare merely the sources of light of the same spectral composition, there are still considerable difficulties to be overcome in order to use selenium. These are the variation of selenium in course of time; the effect which the duration of illumination, the current and the temperature have on the decrease of resistance; finally, the slow return of the selenium cell to its normal resistance in dark.—*Elek. Zeit.,* March 28.

Tests of High-Tension Insulators.—W. Weicker.—A fully illustrated article describing recent extensions of the high-tension testing department of the porcelain factory in Hermsdorf. These extensions became necessary on account of the great increase in the consumption of porcelain insulators. Every one leaving the factory is tested and the number increased from 172,000 in 1902 to 562,000 in 1906. It was further necessary to increase the voltage of testing in view of the higher voltages now being introduced in practice. While formerly a voltage of 100,000 was the maximum employed for testing, this has now been raised to 200,000. For this purpose a special transformer has been provided of a capacity of 50 kilowatts. The two halves of the high-tension winding may be connected either in series or parallel so as to get a testing voltage of either 200,000 or 100,000. The arrangement of the testing room is described in detail and illustrated.—*Elek. Zeit.,* March 28.

Three-Phase Wattmeter.—H. Sack.— A detailed illustrated description of the three-phase wattmeter of the Siemens-Halske Company. It is almost aperiodic, air-damping being used. The electrodynamometric principle is employed so that the readings do not depend on the wave form and frequency. The readings are correct for unbalanced systems, the meter consisting of two separate wattmeters connected to the three-phase system. The two wattmeters are placed one above the other and the movable coils firmly connected so as to move together. Recent changes in the construction of the single-phase wattmeter of the same company are also described and illustrated.—*Elek. Zeit.,* March 21.

Telegraphy, Telephony and Signals.

Breslau.—K. Langbein.—An illustrated article in which the new telephone exchange in Breslau is described in detail. The central battery system is employed for 20.000 subscribers.—*Elek. Zeit.,* March 28, April 4.

Telautography.—A. Korn.—The author has recently improved his method of transmitting photographs or half-tones electrically over wires. In the present article he describes how it is possible to introduce corresponding improvements in the electric transmission of handwriting, drawings, line cuts, etc.—*Phys. Zeit.,* April 1.

Railway Signals.—J. D. Taylor.—A third article of his illustrated serial on railway signalling. The author discusses the electric interlocking system and its development. The switch operation by stray currents, the switch and lock mechanism, the construction of the safety controller for switches are discussed and illustrated. In an editorial note by H. G. Prout it is pointed out that interlocking and block signalling should not be looked at merely as measures of safety, but also of increased efficacy in operation.—*Electric Journal,* April.

Wireless Telegraphy.—J. Goodman.—An article on the adaptation of the slide rule for use in wireless telegraph calculations. It enables one to read, with one manipulation only of the slide, the wave length in meters, and the frequency of oscillations per second, having given only the oscillation constant of the circuit under consideration.—Lond. *Elec.,* April 5.

Miscellaneous.

Electric Heating.—A. Lauri.—An illustrated article on the possibility of making electric heating installations in order to equalize the load curve of a central station. At times of maximum load it becomes necessary to disconnect the heating appliances. The latter must, therefore, be able to store enough heat which they can give off, after they have been disconnected. For this reason it is important to use sufficiently large masses for the heating appliances. Constructions of Dutch-tile ovens, containing the heating resistances embedded in cement, and also another construction of an iron oven are described and illustrated.—*Elek. Zeit.,* March 21.

Cost.—For manufacturers it is of great importance to give proper attention to the ratio of cost to selling price. If the cost is not exactly known for every manufactured article it is difficult to determine how far it is possible to go down with the price in competition with others. A proper system of accurately calculating the cost of a manufactured article is of greatest importance, and the Society for Commercial Education in Frankfurt invites a price competition for monographs on the calculation of the cost.—*Elek. Zeit.,* March 21.

Hospitalier.—A biographical sketch, written by C. E. Guillaume, of the life and work of the late Edouard Hospitalier.—*L'Ind. Elec.,* March 25.

BOOK REVIEWS.

Entwurf Von Schaltungen und Schaltapparaten. Vol. I. By Robert Edler. Hannover, Max Janecke. 192 pages, 186 illus. Price, 6 marks.

The volume discusses the theory of switch combinations from an electrotechnical standpoint that is not exactly mathematical and yet bears resemblance to mathematical method. The book is divided into four sections. The first is a brief introduction into the nature of switching-theory. The second deals with special forms of switches for simple arc and incandescent lamp installations. The third deals with storage battery switches and controllers. The fourth considers controllers for cranes, automobiles and electric railroad cars. Some very complicated switchings are considered and yet there are many very practical examples. The book is amply illustrated and will be of interest to the student of controllers and controller manufacture. The book would be improved if it were provided with an index.

La Construction des Machines Electriques. By Julien Dalemont. Paris: Ch. Beranger. 138 pages, 128 illustrations. Price, 2.50 francs.

The finished product of electrical works is the result of the systematized efforts of many, from its first inception in the designing office to the manual labor of the carter who removes it from the works. The management of large industrial establishments involves not only the utilization of the concerted efforts of men, but also the assistance of machines and tools. In the organization of machine work many important problems arise and upon the successful solution of these depend to a great extent the financial results. The present book deals with these problems, and subjects of much importance are discussed with great competency.

Machine tools and machines required for the shaping and construction of the various parts of electric machinery are thoroughly discussed in the first chapters. The winding room, the different methods of construction of the coils and how machines are wound, are given special attention. The setting up of the machines in the erecting shop is also given due discussion.

The book is a valuable one for the engineer in the employ of manufacturing companies, as it will explain many obscure points about the utility of machines and the organization of electric works in general. To the student it will be a valuable reference book, interesting to read, and from which valuable information will be obtained.

Gas and Oil Engines. By Horace Allen. Manchester: Scientific Publishing Company. 548 pages, 243 illustrations. Price, 12s. 6d.

The chapters in this book treat of details of gas engines, application of the working charge, regulation, ignition, governing the power developed, application and development of cams, cyclic irregularity, construction of fly wheels for gas engines, vertical engines, two-cycle engines, scavenging, compounding, oil engines, marine engines, carburetters, petrol motors, starting engines, silencing the exhaust, the cost of power, the indicator, blast furnace gas, pressure and suction gas producers, arrangement for exhaust utilization, and testing gas and oil engines.

The chapter on "General Description of Gas Engines by Various Makers," contains a comprehensive description of 17 different engines. Nearly all of these descriptions are illustrated by outline cuts showing the several parts very clearly. This is true of a majority of the illustrations in all of the chapters, thus enabling a much better idea of the design and construction of these machines to be obtained than usually can be gathered in works on this subject.

The illustrations of gas producers and gas engines used in connection with them, in marine service, show that it is practicable to construct an outfit of this kind without occupying a prohibitive amount of space in the boats propelled by them. While this book treats almost exclusively of foreign practice, there is much in it of interest and value to American engineers engaged directly or indirectly in gas and oil engine service in their varied applications.

Combustion and Smokeless Furnaces. By Jos. W. Hays. New York: Hill Publishing Company. 101 pages. Price, $1.50.

The author of this book has gathered scattered information on the smoke nuisance, on furnaces that have proved successful in abating this nuisance, and put it into compact form where it is available for the steam user and engineer to use at pleasure.

Chapter 1 contains a brief description of combustion, and theories concerning the nature of heat. The relation of combustion to boiler furnaces is condensed in Chapter 2, while its relation to the steam boiler is made plain in Chapter 3. "The Chimney Evil" is the suggestive title of Chapter 4, and a consideration of smokeless furnaces is found in Chapter 5. The advantages of mechanical stokers are presented in Chapter 6, while hand-fired furnaces in connection with forced draft forms the subject of Chapter 7. "Some Conclusions" are presented in Chapter 8 of an interesting nature, one of which is as follows: "The man who is looking for absolute perfection in this field will be disappointed, for nothing in the furnace line can be endowed with the factor of intelligence; and even if so endowed, it would often have a hard proposition to contend with, in the ignorance and carelessness of the men in charge of the boiler."

While the causes which led to the expression of such an unfavorable opinion of boiler operators are not pleasant to contemplate, the frankness of expression should tend to improvement along this line, as it is evidently needed.

While little more than a collection of notes and lacking in perspective and literary art, the work should nevertheless prove instructive to all who are seeking information on the subjects of which it treats. In printing, paper and binding the book is a primitive specimen of the book-making art.

Fowler's Mechanical Engineer's Pocket Book, 1907. By William H. Fowler. Manchester: Scientific Publishing Company. 542 pages, illustrated. Price, 2s. 9d.

This well known mechanical engineer's pocketbook contains the usual amount of condensed information, to which have been added 20 pages of up-to-date matter on steam turbines. The data relating to gas engines and gases used to operate them are of special value to the progressive engineer. The report of trials of eight different gas producer plants contains practical information not easily accessible elsewhere. Oil engines are treated briefly, but the information given concerning their performance is worthy of attention, as it affords means for comparing the cost of operation with that of other prime movers. While this book is more especially devoted to English practice along all mechanical lines, there is much in it of universal value.

General Electric Company's Exhibit at the Jamestown Exposition.

Although electricity plays a most important part at the Jamestown Exposition, the management felt it advisable not to set aside a separate building for electrical exhibits. Two principal exhibit halls have been built. One of these, the Machinery and Transportation Building, includes the exhibits of electrical machinery, and in this building the main sub-station and distributing switchboard of the exposition are located. Inasmuch as all of the electrical apparatus in the sub-station as well as that used by the Exposition Company around the grounds, was furnished by the General Electric Company, its exhibit has been confined to illustrating various industrial and domestic applications of electricity. This exhibit is located adjacent to the sub-station and is filled with a most interesting variety of devices, many operated by electric motors. One section has been fitted up as a model electric kitchen with a spacious dining room adjoining which will be used as reception quarters for guests.

One of the interesting features is the small refrigerating plant operated by motor so arranged that the liquid passes through an adjacent section of the railing which, of course, is covered by a heavy white frost. Another unique application of the electric motor is seen in the Seth Thomas clock with 24-in. dials in full operation wound regularly by motor. An electrically operated floor surfacer and polisher is worthy of comment. A motor driven washing machine attracts as much as the sewing machine operated by electricity. The electric cream separator is now quite generally used, and this company is furnishing the motors for driving an exhibition where cows are milked by electricity in another part of the grounds.

The electric dough-mixer shown by the General Electric Company has proved a most useful device. Two designs of electric hair dryers are here exhibited and the electric heating pad is also shown. The electrically operated circular saw and a new form of electric bench drill, motor driven lathe, and a small portable forge fitted with electric blower, form an interesting part of the exhibit. There are also a number of small grinders, buffers, and polishers for use of jewelers and in small shops. Several types of ventilating blowers are shown and the exhibit of ordinary electric fans is very complete. In fact, this promises to be one of the most useful parts of an exhibit located in the mild latitude of Norfolk.

In the electric kitchen is to be found an elaborate collection of the General Electric electric heating and cooking utensils. These will be in full operation during the exposition. The dining room is attractively fitted up in Flemish oak with dark red burlap wall and a handsome mantel. Instead of gas logs, a luminous electric radiator has been installed in the fireplace. In the ceiling of the dining room a comprehensive showing is made of the incandescent units, including the "Gem" in various sizes and the new tantalum lamps, all equipped with various forms of holophane reflectors.

The main part of the exhibit is illuminated by G. E. enclosed arc lamps fitted with concentric diffusers. Edison incandescent lamps are used throughout for lighting the exposition buildings, and the company exhibits this type of lamp as well as some of its other standard lamps with interesting information as to the annual production.

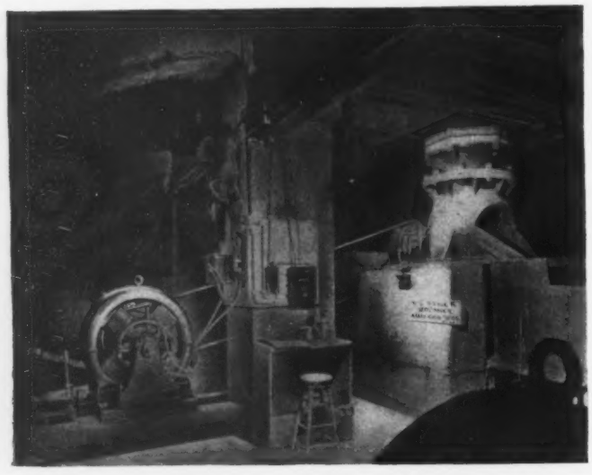
As indicative of certain uses of the electric motor an Edison business phonograph with wax shaving device is exhibited as well as a talking phonograph, all operated by small motors. The talking phonograph is used to explain the operation of the

other phonograph and various devices in the exhibit. An electrically driven house pump is shown in operation, and an electric renovator in the form of a carpet sweeper forms an unusually interesting application of the electric motor.

The General Electric Company will also furnish for use about the exposition grounds more than a score of powerful electric searchlights, and in the exhibit made by the Navy Bureau of Equipment is to be found a small Curtis steam turbine of the type and size used on board ship. Here also is exhibited the new electric fire room timing device.

Motor-Driven Rock Crushers.

A notable example of economy of both material and labor, in dismantling stone and brick buildings was afforded by the work of tearing down the old Cook County Court House, in Chicago. The contractors, J. A. McMahon & Co., erected a temporary rock-crushing plant and were able to sell the crushed rock right in the center of Chicago; in fact, towards the close of the work they did not find it necessary to remove any of the material



MOTOR-DRIVEN ROCK CRUSHER.

from the premises, but disposed of it directly to the firm putting up the new structure. The crushing plant consisted of two Gates breakers, a Gates revolving screen, each being driven by an Allis-Chalmers direct-current motor. To the ready adaptability of the motors is to be attributed largely the success of the equipment.

Portable Combination Current, E. M. F. and Power Meter.

The H. W. Johns-Manville Company, New York, is offering to the trade a portable combination current, e. m. f., and power

CURRENT, E. M. F. AND POWER METER.

meter based on the principles employed in a similar instrument for switchboard use which it placed on the market somewhat over one year ago. The meter consists of two separate and complete instruments in a single case, the one indicating in volts and the other in amperes. The third and fourth indications are obtained on a scale plotted at the center of the dial, giving the product, or power consumption, in watts or kilowatts and horsepower. The latter readings are taken at the points of intersection of the two indicators. The power scale is calibrated in "watts" or "kilowatts" on one side and "horsepower" on the other. The convenience of having in one instrument a portable meter reading in volts, amperes, watts and horsepower is readily appreciated at a glance, as this meter is adapted for rapid testing in the laboratory or for field work. It has been found especially suitable for taking readings on electric cars, electric elevators, etc.

Portable Air Compressors.

One of the most noteworthy developments in the history of mechanical progress, during the past few years, has been the constantly increasing use of compressed air for a great variety of industrial purposes. Pneumatic tools and other appliances for the utilization of this product have been gradually introduced into one field after another, with such satisfactory results that the benefits to be derived from the use of compressed air, for operations covering a wide range of service, are now fully recognized. In many cases it is also found advantageous to use an air-compressor which, with its various accessories, can be brought directly to the work, instead of having its product transmitted from a distance.

A well known and serviceable machine of this type is the Christensen portable air compressor, now manufactured solely by the Allis-Chalmers Company. Many thousands of these compressors are in service throughout the United States, as well as abroad. The equipment furnished consists of the following parts: Motor-driven compressor, automatic governor, switch and fuse, reservoir, air gauge, connection pipe, hose and fittings.

The entire apparatus is mounted on an ordinary four-wheel platform truck. The compressor is designed in the most compact form possible. Its connecting rods are operated by a drop forged steel crank shaft, set at such an angle as to give the best balance to moving parts. The crank shaft is extended at one end to receive a double helical gear, which meshes with the pinion of armature shaft directly above. The gear is cut with two keyways, which are placed at 90 degrees apart, so that when the teeth of the gear are worn on the sides, corresponding to the greatest pressure on the piston, the gear may be shifted at a corresponding angle on its crank shaft to present another set of teeth, thereby keeping the wear even. The motor base forms a cover for the compressor, and a suitable casing is provided for the gear. The compressor base is filled with oil at the filling elbow provided for that purpose, and all of the working parts operate in a bath of oil.

The motor for operating this compressor is of the series type (started and stopped without resistance of any kind) the coils of which are form-wound and thoroughly insulated. It is very carefully built, both mechanically and electrically, and so constructed that the armature and fields can be removed, if necessary, without disturbing any other parts of the machine.

The automatic governor is so designed as to start and stop the motor compressor at minimum and maximum pressures respectively. The mechanism of this governor consists of an ordinary pressure gauge which is actuated by the compressed air in the main reservoir. When the maximum pressure is reached, a contact is formed by means of this mechanism in such a way that the motor circuit is open, and upon lowering the pressure to the minimum point the circuit is closed, a magnetic blow-out coil being provided for extinguishing the arc and preventing the burning of the contacts. All of these parts are accessible for inspection and repairs.

The reservoir is of seamless cold drawn steel made in one piece, with the bottom pressed in and the end of the reservoir shell beaded over to form a joint, which is afterwards made

solid and tight by brazing and tinning. These reservoirs are tested at 300 lbs. hydraulic pressure.

These compressors are furnished for capacities of 11, 16, 20 and 50 cubic ft. of free air per minute. Each is constructed throughout with sufficient strength to withstand a working pressure of 100 lbs. per sq. in. The motors are designed for all standard voltages, as required.

Variable-Speed Motor Controllers.

The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., is placing upon the market a complete line of controllers for use with variable-speed motors. These controllers have been designed to meet the conditions in printing press and machine tool work where a speed range of 4 to 1 is obtained by varying the field strength. Each controller is provided with an auxiliary breaking device equipped with a powerful magnetic blowout. In opening the circuit by moving the lever to the "off" position the break does not occur on the contacts, but on the auxiliary device located just below the contact segments, thereby preventing arcing on the contacts. The contact segments themselves are of hard-drawn copper and are separately renewable.

The controller is equipped with a cast-iron cover which completely encloses all of the apparatus except the handle of the operating lever. The lever itself is formed with a projecting arm carrying the contact shoe for the field speed points. This construction contributes to the compact arrangement of the controller. All contact parts are removable from the slate front without disturbing the interior connection, and all terminals are labelled with brass tags, thereby insuring proper wiring.

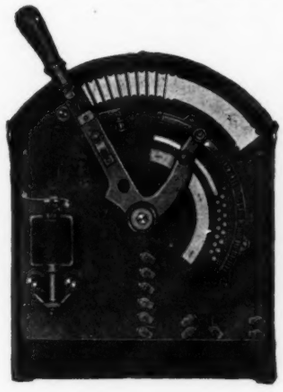


FIG. 1.—NON-REVERSIBLE COMPOUND CONTROLLER WITH UNDERLOAD RELEASE.

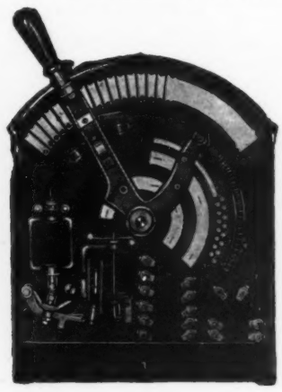


FIG. 2.—REVERSIBLE COMPOUND CONTROLLER WITH OVERLOAD AND PUSH BUTTON RELEASE AND DYNAMIC BRAKE.

The speed regulation is effected by varying both the armature and the field circuit resistances. Six distinct pieces of apparatus are comprised in this line of printing press and machine tool controllers—three non-reversible and three reversible. In each class the controller may be provided with underload release only; with underload and overload release, or with underload, overload and push-button release and dynamic brake.

High-Tension Porcelain Insulators.

In the manufacture of high-grade porcelain for insulators there are required as many as eight different kinds of clay secured from various parts of this country and Europe. One of the secrets of success in manufacturing porcelain for electrical purposes resides in the mixing of the clay; a mixture that is good for one type of insulator is not correct for another, and experience alone dictates the character of the mixture required. After the proper mixture has been obtained and worked through to the point of manufacture, then skilled labor is necessary for the purpose of making up the different types of insulators. Skilled labor is again required in the drying and glazing process and during the burning in the kilns.

Although the glazing itself does not add materially to the dielectric qualities of an insulator, yet it is important for the insulator to have a smooth surface exposed to the weather so as not to collect or hold moisture or dirt. One of the most important features in the production of high-tension insulators is the tests to which they are subjected to insure a proper factor of safety by ascertaining its ability to withstand the voltage assigned to it without breaking down or arcing over under various climatic conditions.

FIG. 1.—INSULATOR, 5000 VOLTS.

FIG. 2.—INSULATOR, 60,000 VOLTS.

The accompanying illustrations show porcelain insulators constructed by the Ohio Brass Company, Mansfield, Ohio. It will be observed that while a 5000-volt insulator is made in one piece, a 60,000-volt insulator is built up of four pieces. The several parts are held together by the best quality of Portland cement, which is frequently applied before the insulator is shipped from the factory.

Exhibits at Iowa Electrical Convention.

Excellent opportunity was afforded for making exhibits at the Iowa convention, as space was set aside in the basement of the Lafayette Inn, the hotel in which the convention was held.

The Benjamin Electric Manufacturing Company exhibited its wireless clusters and twin sockets. The latter are being made connected in series so that two tantulum lamps can be run in series on a 220-volt circuit.

The Electric Appliance Company of Chicago exhibited a board of Sangamo wattmeters.

The Electric Service Supplies Company made an exhibit of railway line material and arc headlights.

The W. R. Garton Company, Chicago, had a demonstration of fireproof magnet wire operating a coil continuously at a temperature which would burn the insulation off of any ordinary wire.

The H. W. Johns-Manville Company had a line of enclosed fuses and its combination ammeter, voltmeter, wattmeter for direct current, the wattmeter reading being obtained by noting the point of intersection of the voltmeter and ammeter needles.

The General Electric Company exhibited its heating and cooking utensils and the Gem and tungsten lamp.

The American Steel & Wire Company made an exhibit of rail bonds for the benefit of the railway men.

The Fort Wayne Electric Works exhibited its recording wattmeters and Wood arc lamps.

The Westinghouse Electric & Manufacturing Company showed its small type circuit breaker and portable indicating wattmeter.

The Western Electric Company made a special display of Western Electric arc lamps and D. and W. fuses.

The Central Electric Company showed the Columbia tantalum lamp, for which it is agent.

The Fox-Callahan Company, 185 Second street, Milwaukee, showed a very neat form of pipe or terminal hood for leading wires out of the upper end of exposed iron pipe conduit.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—The unseasonable weather retards the development of Spring trade. Cold weather has prevailed over an unusually large area, retarding agricultural progress as well as trade in light-weight wearing apparel and other Spring goods. The only actual damage of any account is reported in some Winter wheat fields of the Southwest, where insects and drought combined to injure grain, and on most of this area some other crop has been planted. Wholesale business for later seasons is on a liberal scale; building operations are active, and leading manufacturing plants are busy. Few labor struggles retard work in the industries. Little complaint is heard regarding freight blockades, and with the resumption of lake navigation on the Northern border traffic conditions will soon be entirely satisfactory. Railway earnings for two weeks of April were 13.6 per cent larger than in the same period last year. Pig iron markets showed a firmer undertone, following the heavy purchases of steel-making irons the week previous. Demand and specifications for most finished lines are remarkably active. The leading interest has opened its books for steel rails for 1908 delivery, the quotation of $28 being maintained, and it is said that inquiries already aggregate 250,000 tons. Orders for structural steel are fair, and heavy contracts are pending. The copper market displays a number of cross currents, with some quotations showing an easier situation, but the larger domestic interests still hold prices firm. Business in the higher grades, lake and electrolytic, is lighter, as buyers and sellers take diametrically opposite views of the price situation. It is probable, however, that quotations on casting grades and remanufactured copper are shaded. Smelters are busy, shipments are heavy, and it is said that some manufacturers of copper wire are requesting that deliveries of ingots be deferred. Sales throughout the week were at 26 cents for Lake, best brands; 25 at 25¼ cents for electrolytic, all for June and July delivery, and 24¾ at 25 cents for prime casting stock, 60 days. *Bradstreet's* reports 167 business failures during the week ending April 18, against 194 in the previous week and 167 in the corresponding week last year.

THE WESTINGHOUSE MACHINE COMPANY completed its third fiscal year on March 31 last as a regular business organization marketing and selling its own product. Until 1904, the Westinghouse machine Company was a manufacturing concern, pure and simple, its product being made for another company, which sold it. It is interesting to note that during the last three years the business of the Machine Company has been trebled in orders and output. Many additions to the plant have been made and the manufacturing facilities have been repeatedly increased to meet the growing demands for its product. The greatest impetus to the company's business was given when the Westinghouse-Parsons steam turbine was placed upon the market, and when the company entered upon the manufacture of gas engines in large units. The orders secured during the first three months of the present year exceeded by far the aggregate of the business for the same period of last year and there is every indication that the Westinghouse Machine Company's business during 1907 will show a healthy increase.

STEEL CARS FOR BROOKLYN.—Forty all-steel cars are being contracted for by Mr. Theodore P. Shonts, the President of the Interborough Company, for use on the lines of the New York & Queens County Railway, one of the Belmont properties. The cars are all to be supplied with airbrakes. It is the present expectation of the New York and Queens County officials, that the Steinway, or Belmont, tunnel, from the foot of East 42d Street to Long Island City, will be opened for operation about November 1. It is announced that the delivery of all forty of the cars will be required by December 1, and it is expected that some of them will be in operation by November 1. The cars are to be thirty-eight feet long, and will be provided with all recent improvements. They will have cross seats and seating accommodations for 44 passengers each. The approximated cost of each car is $8,000, a total expenditure of $320,000 for rolling stock for the Belmont lines in Queens County. The cars are to be so constructed that they may be operated in the tunnel, which is really the primary reason for adding to the present equipment of the Queens County lines.

THE D. T. WILLIAMS VALVE COMPANY, of Cincinnati, has purchased a large seven-story building, only recently built, in order to increase its manufacturing facilities. A large brass foundry is provided for casting the company's line of specialties, together with machine tools and appliances for finishing the products. The large machine tools will be driven by means of Allis-Chalmers induction motors, direct connected, and the smaller machines will be driven in groups by motors of the same type. These motors will range from 5 to 50 horse power. The group-driven machines will use cone pulleys and speed boxes in order to obtain variable speed on a number of the tools which could not be obtained with direct-connected induction motors. One motor of 50 hp, operating at a speed of 900 r. p. m., will be used to drive an air compressor.

WESTERN ELECTRIC BUSINESS.—A special dispatch from Chicago of April 22, says: The Western Electric Company recently has dropped 5000 out of 25,000 men from its pay rolls. Not hard times, nor the expected approach of hard times, but "too much prosperity," was assigned by President E. M. Barton to-day as the cause of the company's action. "The high prices for copper, steel, and lead metals, which we use very largely, make construction of plants in which our apparatus is used very much more expensive that at any time for twenty-five years," he said. "Our customers, then, have to face the probability that the plant put in at the present rate of cost could be duplicated within a few years at greatly reduced outlay. The fundamental difficulty, therefore, is too much prosperity."

DIXON CRUCIBLE.—At the annual meeting of the stockholders of the Joseph Dixon Crucible Company the old board, consisting of Edward F. C. Young, John A. Walker, Edward L. Young, William Murray, George T. Smith, Joseph D. Bedle and George E. Long, was unanimously re-elected. The Board of Directors re-elected the former officers, namely, E. F. C. Young, president; John A. Walker, vice-president and treasurer; George E. Long, secretary. Judge Joseph D. Bedle was also re-elected as counsel. The stockholders present expressed themselves as thoroughly satisfied with the management of the company by its officers. Of the total number, 7345 shares, there were represented 6460 shares.

THE MALLORY LINE WITH WIRELESS.—The Mallory Steamship Company (Morse Lines) was the first American steamship line to adopt wireless telegraph. After giving the invention a thorough test on its steamships "San Jacinto," "Denver" and "Concho," have arranged to equip the remainder of the fleet. The steamships "Lampasas," "Sabina" and "Rio Grande," of the Mobile fleet will be installed first. The steamships "Nueces," "Alamo," "San Marcos," "Comal" and "Colorado" to follow. The DeForest system will be used.

FOR DRIVING LAUNDRY MACHINERY.—The Troy Laundry Machinery Company, Ltd., of Chicago, has recently placed an order for Allis-Chalmers electric generators and motors to be used for operating the laundry establishments of the Morgan Steam Laundry of New York City, with branches in New York, Boston, St. Louis and Chicago. The equipment included in the contract comprises two engine type direct-current generators, 75 and 125 kw, respectively, and 13 direct-current motors ranging from 5 to 30 hp.

THE OHIO VALLEY FINANCE COMPANY, which is building an electric railway from East Liverpool to Stubenville, Ohio, has concluded a contract with the Westinghouse Companies for the power house equipment that will operate the road. This will include three 1000 hp Westinghouse-Parsons steam turbines, three electric turbo-generators of a corresponding capacity, as well as rotary converters and requisite switchboard apparatus.

ELECTRIC CRANES IN SOUTH AFRICA.—Referring to his report published in Daily Consular and Trade Reports on January 31, Consul W. Stanley Hollis now writes from Lourenço Marquez: Relating to the crane equipment on Gorjao wharf, the Lourenço Marquez Port and Railway Commission has decided to install an additional number of 3 and 5 ton electric cranes on the wharf and either a stationary or a floating crane or derrick, with a lifting capacity of from 50 to 60 tons. The present cranes in use are of German manufacture. They are revolving cranes, supported upon strong elevated frames, running with their own power up and down the water front of the wharf. Under each crane and between the side frames is a clear space, through which a train of narrow 3-feet 6-inch gauge freight cars may run. The power for running these trains is supplied by the local street railway company. It is suggested that American manufacturers who can supply cranes likely to be acceptable to the port and railway commission should write to its official engineering head, His Excellency Major Costa Serrao, Inspector das Obras Publicas da Provincia, Lourenço Marquez, Portuguese South Africa.

GENERAL ELECTRIC BUSINESS.—The General Electric Company has received an order from the Mexico Tramways Company, of Mexico City, for 15 4-motor equipments with automatic control. The operating trains will consist of two motor cars with one trail car placed between them. The railway company has also purchased ten motor equipments with special auxiliary contractor control. The company has also received an order from the Mexican Sugar Refining Company for two generators to furnish power for the sugar centrifugals. The Queens Consolidated Copper Company will install at Nacozari, Sonora and Mexico City three large steam turbine engines which will be the largest turbine plant in Mexico. In one week recently 9,500,000 pounds of electrical machinery and supplies were shipped from the Schenectady plant of the General Electric Company.

NEW YORK LIGHTING BILLS.—Chief Engineer Lacombe of the Department of Water Supply, Gas, and Electricity has recommended that the city make a settlement with the Consolidated Gas Company and the subsidiary concerns of the old city lighting bills, the arrears of which are now drawing interest at 6 per cent. The basis of settlement to be proposed will probably be the payment of all electric-lighting bills at the present legislative rate, the payment in full of all arrears prior to Feb. 6, 1906, and the payment for gas furnished since then at the rate of 75 cents a thousand.

LARGE CAR ORDER.—The Interborough-Metropolitan Company has placed orders for a total of 250 cars. Fifty of the cars will be of all steel construction and will be used in the subway. The remaining two hundred cars will be used on the elevated. The contracts call for delivery as soon as possible. The fifty subway cars are to be built by the American Car and Foundry Company. The contract for the two hundred elevated cars has been divided among the St. Louis Car Company, the J. G. Brill Company and the Wason Company.

TELEPHONE IMPROVEMENTS.—The Cincinnati & Suburban Bell Telephone Company has let contracts for improvements involving an expenditure of some $117,000.

Financial Intelligence.

THE WEEK IN WALL STREET.—The stock market was very inactive. Easy money failed to have any effect, and the uncertainty about the position of railway and other properties as a consequence of pending legislation, tended to conservatism on all sides. There was better crop news, the advices from the West tending to minimize previous reports of severe and extensive damage to the grain crops. Money continues very easy and the banks gained a further considerable amount from the Treasury as a result of the policy in regard to government deposits and bond redemption. Toward the end of the week the market became narrower and its fluctuations were of a very limited character. The continued talk about present and prospective drops in copper prices had an unsettling effect on Amalgamated, although the street was not particularly disappointed by the news that no change was made in the quarterly dividend of that stock. There was a dearth of other incidents bearing on the railroad situation, and the complications which have arisen in regard to the Chicago Terminal Traction organization were not of a kind to have any effect on the market. Discussion continues to be heard about the coming dividend on United States Steel, common, although the weight of opinion in that respect is that no increase may be anticipated. Electric stocks were quiet, in sympathy with the rest of the market, and the tendency of prices was downward. There were no marked changes, however, one way or the other, the market being simply dull. The only feature of interest in the curb market was the decline of about 30 points in Standard Oil due to a Western court decision adverse to the company. The rest of the market was featureless. Following are the closing quotations of April 23:

NEW YORK.

	Apr. 16	Apr. 23		Apr. 16	Apr. 23
Allis-Chalmers Co.....	11⅜	12¼	General Electric.....	146½	148½
Allis-Chalmers Co. pfd.	32	34	Hudson River Tel.....	..	..
American Dist. Tel....	..	..	Interborough Met. com.	25	25½
American Locomotive..	62¼	64	Interborough Met. pfd.	60	60¼
Amer. Locomotive pfd.	106	105	Mackay Cos.....	..	..
American Tel. & Cable.	75	75	Mackay Cos. pfd.....	..	..
American Tel. & Tel..	..	..	Marconi Tel.....	..	..
Brooklyn Rapid Transit	60⅛	60⅜	Metropolitan St. Ry...	..	..
Electric Boat	28	25	N. Y. & N. J. Tel....	..	..
Electric Boat pfd.....	78	78	Western Union Tel....	82¾	83¼
Electric Vehicle	..	..	Westinghouse com.....	146	144⅛
Electric Vehicle pfd..	..	..	Westinghouse pfd.....	..	..

BOSTON.

	Apr. 16	Apr. 23		Apr. 16	Apr. 23
American Tel. & Tel...	123¼	123½	Mass. Elec. Ry. pfd....	59½	59½
Cumberland Telephone.	..	117½	Mexican Telephone....	..	..
Edison Elec. Illum....	201	211	New England Telep...	120	120
General Electric	147½	150	Western Tel. & Tel...	7	7
Mass. Elec. Ry.....	17	..	West. Tel. & Tel. pfd.	70¼	70

PHILADELPHIA.

	Apr. 16	Apr. 23		Apr. 16	Apr. 23
American Railways....	49¾	49½	Phila. Electric.....	8⅜	8⅜
Elec. Co. of America..	10	10	Phila. Rapid Trans....	17½	19
Elec. Storage Battery..	54½	53½	Phila. Traction.....	94⅛	94
Elec. Storage Bat. pfd.	..	..			

CHICAGO.

	Apr. 16	Apr. 23		Apr. 16	Apr. 23
Chicago City Ry.....*	180	180	National Carbon.....	76	76
Chicago Edison	..	143	National Carbon pfd..	*111	111
Chicago Subway	20	17½	Union Traction	..	..
Chicago Tel. Co.....	..	..	Union Traction pfd....	..	..
Metropolitan Elec. com.	24	24			

*Asked.

DIVIDENDS.—The directors of the American Light & Traction Company have declared the regular quarterly dividends of 1½ per cent on the preferred stock, and 1¼ per cent on the common stock, payable May 1. The Electric Securities Corporation has declared a semi-annual dividend of 2½ per cent on the preferred. Directors of the American Graphophone Company have declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable May 15. The directors of the Cleveland Electric Railway Company have declared a quarterly dividend of three-fourths of one per cent on its stock, payable April 15. The company paid dividends at the rate of 1¼ per cent quarterly last year. From 1901 to 1905, inclusive, the rate was 4 per cent per annum. The present reduction is due to the falling off in earnings on account of the ordinance enforcing sale of seven tickets for 25 cents. Directors of the East St. Louis & Suburban Railway Company have declared a quarterly dividend of 1¼ per cent on the preferred stock, payable May 1. Directors of the Chicago Edison Company have declared the regular quarterly dividend of 2 per cent, payable May 1. Directors of the Montreal Light, Heat & Power Company have declared the regular quarterly dividend of 1¼ per cent, payable May 15.

BOSTON EDISON GROWTH.—Advices from Boston state that for March the business of the Edison Company increased 14 per cent over the corresponding month a year ago, while the amount of strictly new business secured was double that of a year ago. So far this month the percentage of increase is even larger than last month, due to the abnormally large number of dark days. The management has anticipated the present growth and ordered two additional turbines, one of which will be installed this fall, with a capacity of 5000 kw. With these in place the company will have in operation four turbines of 5000 kw capacity and one of 8000-kw capacity. The 5000-kw turbines cost about $125,000 each, exclusive of cost of setting up, while the 8000-kw turbine costs about $200,000. The company has a floating debt of rising $1,500,000, which will be carried along for some time, owing to the failure of stockholders to subscribe to the new stock recently offered at $215 a share as ordered by the lighting commission. The failure of the stockholders to take this new stock is believed by the officials to be in part responsible for the recent decline in the stock to around $200 a share. It is contended that had the commission fixed the subscription price at $200 a share, all the new stock would have been taken by the stockholders instead of only 5 per cent.

NEW ORLEANS ANNUAL REPORT.—The annual report of the New Orleans Railway & Light Company, for the year ended December 31, 1906, is the first report for a full year's operation issued by the company, as a reorganization of the New Orleans Railway Company. Total gross earnings during 1906 increased 13.34 per cent, as compared with an increase of 8.97 per cent during 1905, while net earnings during 1906 increased 11.43 per cent, as compared with an increase of 11.33 per cent for 1906. The operating ratio for 1906 was 53.25 per cent and that for 1905 was 52.45 per cent. During 1906 the company earned its full preferred dividends of 5 per cent on the $10,000,000 preferred stock and a balance equal to 1.49 per cent on the $20,000,000 common stock. These earnings on the stock for 1906, according to the president's report, were after allowing for expenditures believed to have been ample to maintain the property in serviceable condition. The subjoined table shows the actual and percentage increases in the items of the income accounts for both 1906 and 1905 compared with those of the preceding year in each instance:

	Increases.			
	1906.		1905.	
	Amount.	Per ct.	Amount.	Per ct.
Railway gross	$432,311	13.13	$220,032	7.15
Electric and gas gross	169,593	9.94	164,232	10.65
Miscellaneous gross	77,577	80.86	35,101	57.69
Total gross earnings	679,481	13.34	419,365	8.97
Railway expenses	324,496	17.07	147,364	8.41
Electric and gas expenses	78,059	10.14	25,574	3.43
Total expenses	402,555	15.07	172,938	6.92
Net earnings	276,926	11.43	246,427	11.33

As will be seen, the lighting business though smaller is more profitable than the transportation.

ST. LAWRENCE POWER.—A company of financiers with George C. Foster, a Canadian capitalist, as chief promoter, has obtained control of the water rights in the Cornwall Canal, including the power house at Mille Roches, opposite Massena. In connection with this deal it is announced that the Pittsburg Reduction Company, which enjoys a practical monopoly of the manufacture of aluminum on this continent, will further extend its works in Canada. The company has a mammoth power plant at Massena, another at Niagara Falls and large works at Shawinigan Falls. The company, it is understood, has purchased Bernhard Island, near Mille Roches, on the St. Lawrence a short distance from Massena. It is said to be the intention of the promoters to develop the power in the canal by deepening Hoop Pole Creek, by which they will be enabled to divert a large quantity of water into the canal, thus making it available for power purposes. It is supposed that the Pittsburg company will establish a huge plant at or near Mille Roches, which can be run under the same management as controls the plant at Massena. The Soulanges Canal power is also to be developed by a Canadian company whose first mortgage bonds are guaranteed by the Montreal Power Company. A group of Ogdensburg capitalists is interested to a large extent in several of the large and important electric power deals which have been put through recently on both sides of the St. Lawrence. The dealings in connection with the contemplated power improvements and developments will mean an expenditure of at least $10,000,000.

TROLLEY MERGER IN INDIANA.—The Terre Haute, Indianapolis & Eastern Traction Company, with an authorized issue of $25,000,000 worth of stock and $10,000,000 worth of bonds, has filed articles of incorporation. This is the holding company toward which the plans of the Philadelphia syndicate, represented in Indianapolis by Hugh J. McGowan, have been shaping for nearly two years. It will acquire by purchase or lease all the Indiana syndicate lines, including the Indianapolis & Northwestern, the Indianapolis & Western, the Indianapolis Coal Traction Company (Plainfield Line), the Indianapolis & Martinsville, the Indianapolis & Eastern, and the Richmond Street and Interurban companies. It will not acquire the lines of the Indianapolis Union Traction Company, the Fort Wayne & Wabash Valley Traction Company, nor the Evansville & South Bend properties. It is practically assured that the new company will acquire the lines owned by the Terre Haute Traction & Light Company, including the city lines in Terre Haute, and the interurbans to Clinton, Brazil and Sullivan. It is understood that a proposition will be made by the new company to the Stone and Webster syndicate for the lease for a period of 99 years of the Terre Haute properties. The new company will control 363 miles of traction line in operation. The new company will have close relations with the large holding company, the Indiana, Columbus & Eastern Railway Company.

THE SPOKANE AND INLAND EMPIRE RAILWAY, of the state of Washington, has concluded negotiations with the Westinghouse Electric & Mfg. Company, for furnishing eight 72-ton single-phase electric locomotives. This is an important contract for the reason that the company was one of the first railroads in this country to adopt the alternating current single-phase system; in fact, so thoroughly convinced were the directors of the company that this would be the best for their purpose that the road was built to be equipped with that system. The Spokane & Inland runs from Spokane, Wash., to Lockport, Idaho, a distance of 130 miles. It began operations over a year ago with seven single-phase electric locomotives, operating express, local and freight trains and from the day the first wheel turned the road has been a success. The fact that the growth of business on the road has been phenomenal is shown by the order for this additional equipment of eight more locomotives.

ATLANTA CAPITALIZATION.—The Georgia Railway & Electric Company has filed with the Secretary of State a petition for amendment to its charter, authorizing an increase in the capital stock by $2,004,800, instead of $2,500,000, as has been stated. President Arkright states, however, that another petition asking the additional increase to make up that amount will be filed soon. One-fifth of the total increase will be used to improve the property and the balance will be distributed among stockholders. The petition sets forth that the stockholders voted to increase the capital stock from $8,414,600 to $10,419,400; $2,400,000 preferred, and $8,001,940 common. The company has ordered fifty new cars from Cincinnati, chiefly motor cars and suitable for interurban business.

MONTGOMERY, ALA., EARNINGS.—The Montgomery Light and Power Company, of Alabama, reports for the year ended February 28, 1907, as follows:

Gross	$282,688
Expenses	123,714
Net	$158,974
Interest	100,801
Surplus	$58,173

The first consolidated bonds authorized amount to $3,000,000. Total bonds outstanding, including underlying bonds, are $2,085,000.

PHILADELPHIA ELECTRIC ANNUAL.—The Philadelphia Electric Company has issued its annual report for the year ended December 31, 1906. It compares as follows:

	1906.	1905.	1904.	1903.
Gross	$4,503,878	$4,164,113	$3,873,911	$3,669,044
Operating exp., tax. and chgs.	3,683,161	3,353,097	3,167,128	3,057,442
Surplus	$820,717	$811,016	$706,783	$611,602
Dividends	499,935	499,935	406,261	375,035
Surplus	$320,782	$311,081	$300,522	$236,567
Prev. sur.	1,411,737	1,100,656	800,134	563,567
Surplus	$1,732,519	$1,411,737	$1,100,656	$800,134

UNITED RAILWAYS & ELECTRIC.—The annual report of the United Railways & Electric Company states concerning the financial plan adopted by that company last summer that $13,584,000 out of a total of $13,940,000 of income bonds outstanding have accepted it. The report also states that the Maryland Electric Railway Company has available at this date $1,031,667 on deposit for improvements for the United Company, which spent for construction $80,437 during the year. Since the fire in 1904 the company has spent for betterments and improvements $6,891,734.31.

MANILA EARNINGS.—The Manila Electric R. R. & Lighting Corporation reports earnings for March and three months ended March 31 compared as follows:

	1907.	1906.		Changes.
March gross	$78,000	$72,500	Inc.	$5,500
Expenses	37,750	38,648	Dec.	898
March net	40,250	$33,852	Inc.	$6,398
Three months gross	$229,000	$220,880	Inc.	$8,120
Expenses	113,750	114,339	Dec.	589
Three months net	$115,250	$106,541	Inc.	$8,709

LARGE TELEPHONE LOAN.—A mortgage to secure the $25,000,000 bond issue of the American Union Telephone Company, which controls most of the independent lines in Pennsylvania and adjacent states, was filed in the Dauphin County Court, Harrisburg, Pa., on April 20. The mortgage was given to the Fidelity Title and Trust Company of Pittsburg, trustee for the issue.

GENERAL NEWS

Construction News.

LESLIE, ARK.—J. W. Vaugin is planning the construction of an electric light and ice plant for the towns of Marshall and Leslie.

LEMOORE, CAL.—The Lemoore Ice & Power Company has applied to the City Trustees for a franchise to construct and operate an electric and steam power plant in this city for a term of 50 years.

LOS GATOS, CAL.—The Los Gatos Ice & Power Company and the Los Gatos Gas Company have been consolidated under the name of the Los Gatos Ice, Gas & Electric Company. The directors of the new company are George W. Hume, J. D. Farwell and J. Deming. The capital stock is $200,000. The new company is planning to enlarge the plant.

OAKLAND, CAL.—The Board of Supervisors has awarded a contract to the Suburban Electric Light Company for lighting the county road at $5 per lamp per month.

PALO ALTO, CAL.—The Pacific Telephone & Telegraph Company is planning extensive improvements to its service in this city, which will involve an expenditure of about $65,000.

SAN FRANCISCO, CAL.—The Merchants' Association of Fillmore Street has raised a fund to install a lighting system to illuminate the street permanently from McAllister to Sacramento. The system will be installed by the Butte Engineering & Electric Company and will cost $10,000.

SAN FRANCISCO, CAL.—Chief Hewitt, of the Department of Electricity, has filed with the Board of Supervisers an estimate that he would require $129,450 for maintenance and repairs during the next fiscal year. Mr. Hewitt also asks for $200,000 for an office building and necessary machinery, $275,000 for the rehabilitation of the city's underground system, and $50,000 for rehabilitation of the overhead system.

SAN FRANCISCO, CAL.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., April 30, to furnish at the Navy Yard, Mare Island, Cal., supplies as follows: Electric conductor, steel, copper pipe, etc. Applications for proposals and blanks will be furnished upon application to the office of the navy yard, San Francisco, or at the bureau. E. B. Rogers, paymaster-general, U. S. N.

SONORA, CAL.—The Bourbon Mining Company is contemplating the installation of a small electric power plant to furnish electricity for lighting and operating its mines. A telephone line will also be installed to connect with Columbia.

HARTFORD, CONN.—The Waterbury & Milldale Tramway Company is authorized to construct and operate a trolley line in the towns of Waterbury, Wolcott, Cheshire and Southington. It has a capital stock of $300,000, and the incorporators are Waterbury and Southington capitalists. The Windsor Locks & Western Street Railway Company has also been incorporated to construct an electric line from Windsor Locks to East Granby. The company has a capital stock of $100,000.

MIDDLETOWN, CONN.—The Consolidated Railway Company has awarded the contract for the construction of its power house in this city to C. W. Murdock. Three generators of 1,000-kw capacity will be installed.

TORRINGTON, CONN.—The Torrington Electric Light Company is contemplating increasing the capacity of its plant and will install new generators. The system will be changed to 60 cycles, which will require new wiring throughout the borough.

WILMINGTON, DEL.—Plans have been completed for the electric light and power plant to be installed at the Tenth Street water works pumping station. Theodore A. Leisen is chief engineer water commissioners.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until May 7, to furnish at the navy yards, etc., Portsmouth, N. H.; Boston, Mass.; New York, N. Y.; Washington, D. C.; Norfolk, Va.; Pensacola, Fla., and New Orleans, La., a quantity of machine tools, etc., as follows: Schedule 674—Portable hoisting engine. Schedule 677—Hydraulic accumulator, hydraulic riveter, hydraulic flanging machine, water tube boiler, etc. Also until May 14 to furnish at the navy yards, etc., Portsmouth, N. H.; Boston, Mass.; New York, N. Y.; League Island, Pa.; Washington, D. C., and Norfolk, Va., a quantity of naval supplies as follows: Schedule 679—Sheet copper, etc. Schedule 680—Electric cable, etc. Schedule 683—Circuit breakers, etc. Applications for proposals should designate the schedules desired by number. E. B. Rogers, paymaster-general, U. S. N.

TAMPA, FLA.—The Tampa Electric Light Company has secured a franchise for an electric light plant. P. D. Knight is vice-president.

AUGUSTA, GA.—The Augusta Railway & Electric Company has submitted a proposition to the city for lighting the city. The company offers to take a five-year contract at the present rate of $68 per lamp per year, a three-year contract at $75 per lamp or a contract for a year at $80 per lamp

VIENNA, GA.—J. A. Walden, city clerk, writes that the citizens on April 8 voted to issue $10,000 in bonds for constructing an electric light plant. No engineer has been selected as yet.

BELLEVILLE, ILL.—The City Council has granted the Bell Telephone Company permission to construct underground conduits in the business section of the city.

CARTHAGE, ILL.—It is said that the Carthage Electric Light & Power Company will supply electric power for operating the new interurban electric railway which will be built from Carthage to Fort Madison, Ia.

CHICAGO, ILL.—The capital stock of the Allen Electric Company has been increased from $20,000 to $50,000.

CHICAGO, ILL.—We are informed that bids will be received until May 29 for the installation of electrical apparatus in the Western Avenue transformer sub-station. E. B. Ellicott is city electrician.

CHICAGO. ILL.—Bids will be received until May 1 by the South Park Commissioners for the following: Lead-covered insulated copper cable for conduit system connecting parks and squares with the new power station, Cottage Grove avenue, near Fifty-eighth Street; furnishing and installing in said power station one vertical steam-engine-driven 35-kw exciter unit, together with accessories and appurtenances, and one vertical single or double cylinder steam engine, with extended shaft, extended sub-base and outboard bearing, together with all accessories and appurtenances. E. G. Shumway is secretary.

SHEFFIELD, ILL.—The Sheffield Electric Light Company has secured a franchise for an electric light plant.

URBANA, ILL.—The Urbana Electric Light, Heat & Power Company has been granted a six-year extension of its franchise by the City Council.

ALEXANDRIA, IND.—The plant of the Alexandria Electric Light & Power Company will be sold at auction by the receiver, the Anderson Trust Company, on May 18.

CANNELTON, IND.—A movement is on foot to extend the Evansville & Boonville Electric Railway from Boonville to Cannelton.

DANVILLE, IND.—The City Council has granted Charles R. Lane and associates, of Fort Wayne, a franchise for the construction and operation of an electric light, heat and power plant.

EVANSVILLE, IND.—The City Council has passed an ordinance requiring all the wire-using companies to place their wires underground. At a conference between the managers and the city authorities September 1 was agreed upon as the date when the work shall be completed.

EVANSVILLE, IND.—The Evansville, Gas and Electric Light Company has purchased additional land adjoining its plant and while no official announcement is made it is understood the plant will be enlarged and other extensive improvements made.

FRANKFORT, IND.—The Frankfort, Delphi & Northern Traction Company has been granted a 35 years' franchise. W. H. Cohee, of this city, and a number of Indianapolis men are back of the enterprise. The right of way was secured some time ago and it is announced that work will begin May 1. The company has paid part of the contract price on the Pyrmont mill property, on which it holds an option and which it proposes to utilize for power.

GREENFIELD, IND.—R. S. Ashe has secured the contract for re-equipping the electric light plant for $27,500.

LAFAYETTE, IND.—The Board of Trustees of the State Soldiers' Home, W. S. Haggard, chairman, is asking for bids for the following equipment: Two 200-hp boilers, one 200-hp direct-connected engine, one 150-kw dynamo, one 3-ton capacity cold storage and ice plant, and other electrical equipment.

LA PORTE, IND.—The Goshen, South Bend & Chicago Railroad Company has purchased a site on the Little Kankakee River, ten miles east of this city, on which it will erect a large power house.

LEBANON, IND.—The Lebanon Electric Light Company is considering the expenditure of about $35,000 for improvements.

MICHIGAN CITY, IND.—The Michigan City & Northern Indiana Gas Company has increased its capital stock from $220,000 to $687,500. This is a preliminary step toward the merging with the Michigan City Light & Power Company. The new company will make extensive improvements in the properties and proposes to furnish light, heat and power to the city and surrounding communities.

RUSSELLVILLE, IND.—The Russellville Co-Operative Telephone Company has filed amended articles of incorporation, and increased its capital stock. Albert Lindley is president.

SULLIVAN, IND.—Michael McMorrow, of Sullivan, and C. R. McGaughey, of Brazil, have purchased the plant of the Sullivan Heat, Light & Power Company and will expend about $10,000 in improvements.

CEDAR RAPIDS, IA.—The Cedar Rapids & Iowa City Railway & Light Company is in the market for three 500-hp boilers and one 1300-kw

engine and generator, two-phase, 60 cycles. An addition will be built to the power house for the installation of this equipment.

DECORAH, IA.—The citizens of Decorah at a special election held recently voted in favor of granting a franchise to the Minneapolis, Rochester & Dubuque Electric Railway, on condition that the road is completed and in operation in two years.

DES MOINES, IA.—The managers of the Iowa State Fair Grounds are contemplating the installation of a new electric lighting plant in the fair grounds.

ROCK VALLEY, IA.—The citizens have voted to give the Sioux City & Ireton Electric Railway Company a franchise to construct and operate an electric railway in this town.

SIOUX CITY, IA.—Extensive improvements are contemplated by the managers of the State Live Stock Fair Association, among which is an electric lighting plant to be installed by L. L. Kellogg, F. L. Eaton and F. L. Wirick.

WATERLOO, IA.—The Waterloo, Cedar Falls & Northern Railroad Company has ordered two storage batteries of the Gould Storage Battery Company at a cost of $30,000. The company is also contemplating enlarging its power house.

HOLTON, KAN.—Work on the construction of the Holton electric light plant and water works system has commenced, under the supervision of the W. K. Palmer Company, of Kansas City, Mo.

SHAWNEE, KAN.—Benjamin Earnshaw, of this place, has given the Kansas City & Olathe electric line two acres of land near Shawnee for a site for its power plant and car shops.

BOWLING GREEN, KY.—Plans have been completed and presented to Capt. Harry Burgess, Corps Engrs., U. S. A., of Louisville, by the Green River Hydro-Electric Company, of Bowling Green, which will build a $60,000 power plant at Glenmore on Green River, adjoining lock No. 5. The plant will furnish electricity for the city of Bowling Green, 12 miles away. These plans will be forwarded at once to the War Department at Washington, D. C. Work will begin on the construction of the plant as soon as the plans are approved by the Secretary of War.

TRENTON, KY.—The Trenton lighting plant was destroyed by fire on April 15. The plant was installed about four months ago at a cost of about $3,000.

NEW IBERIA, LA.—Work will soon commence on the interurban electric railway between New Iberia and Algiers, to be built by the Bayou Teche Railway & Light Company. The work in this city will be in charge of H. R. Fine.

CALAIS, ME.—It is understood that the Calais Electric Railway Company is to extend its road to Woodland and Robbinston the coming summer.

LEWISTON, ME.—The Lewiston, Waterville & Augusta Railway Company has awarded the contract for the construction of the line to connect Lewiston with Augusta and Waterville, providing for the building of about 50 miles of road, to Gore Brothers, of Boston, Mass. The contract price is about $800,000.

BALTIMORE, MD.—A new unit of 11,250 horse-power has been installed in the Westport power house of the Consolidated Gas, Electric Light & Power Company and is now in operation, making the capacity of the power plant now installed about 30,000 horse-power. The capacity of the boiler house is being increased by the installation of a 650-hp boiler. A contract has been awarded for a new turbo-generator set of the same capacity of the unit just placed in operation, and also a contract for six more 650-hp boilers. This equipment will increase the maximum capacity of the plant to more than 40,000 horse-power.

BROOKLINE, MASS.—A committee of five has been appointed by the Brookline Board of Selectmen to consider the advisability of establishing a municipal lighting plant in the town.

NEW BEDFORD, MASS.—A power house is to be erected by St. Anthony's Church on its property on Acushnet Avenue, from which electricity will be supplied to lamps and heaters in the church, school and other buildings connected with the property.

NORTHBORO, MASS.—At a town meeting held recently the citizens voted to enter into a contract with the Marlboro Electric Company for lighting the town for $1,410 per year.

SPRINGFIELD, MASS.—The United Electric Light Company has decided to reduce its maximum rate for electricity from 18 to 15 cents per kw-hour. The new rate takes effect from April 1.

ASHLEY, MICH.—William Kennett & Sons are considering a project to install a dynamo in their mills and to furnish electricity for lighting the village. The mills are operated by a 60-hp engine.

BAY CITY, MICH.—The Bay City Traction & Electric Company is contemplating enlarging its power house and increasing the equipment of its plant. The capacity of the electric department will be increased by the installation of a 500-kw turbine, and a 750-kw turbine will be placed in the street railway plant. Two 500-hp boilers will also be installed. Work will soon commence on the extensions, which will involve an expenditure of between $50,000 and $100,000.

GRAND RAPIDS, MICH.—The committee of the Water Commission is considering the question of power for operating the new pumping station on Lake Michigan. W. A. Foote, of the Grand Rapids-Muskegon Power Company, has been asked to submit bids for supplying electricity. Gas producing engines are also being considered. L. W. Anderson is city engineer.

PONTIAC, MICH.—The Oakland Telephone Company has purchased a site on which it will erect a telephone exchange.

OLIVIA, MINN.—The Council is considering installing a storage battery for the electric light plant.

WADENA, MINN.—The construction of a new power station for the municipal electric light plant is under consideration.

VICKSBURG, MISS.—The Home Telephone Company has applied to the City Council for a franchise to construct and operate a telephone system in this city.

GLASGOW, MO.—Glasgow Electric Light, Power & Industrial Company, of Glasgow, has filed a statement showing an increase in its capital stock from $7,000 to $15,000.

JEFFERSON CITY, MO.—The Missouri Interurban Electric Railroad Company has awarded the contract for the construction of the road from Sedalia to Jefferson City to the Bell Construction Company. The road will be 80 miles in length.

ST. LOUIS, MO.—Owing to the financial obligations of the city having reached the limit which the law now permits, it will be impossible for the city to build a municipal electric lighting plant before the expiration of the present contracts for city lighting.

HELENA, MONT.—A preliminary survey is being made for the Helena-Butte Electric Railway. A. W. Varharn, engineer of the electric company, and Engineer McKittrick, of the Helena Power Transmission Company, are among the surveying party.

KEENE, N. H.—A new generator is being installed in the plant of the Citizens' Electric Company. The machine is being installed by the Westinghouse Electric & Manufacturing Company.

EAST ORANGE, N. J.—It is reported that all bids for street lighting received until April 8 have been returned to bidders, and new bids will be called for. Edgar Williams is city clerk.

CHARLOTTE, N. Y.—The citizens voted April 17 to issue $10,000 in bonds for improvements to the electric light plant.

COLD SPRING HARBOR, N. Y.—The Town Board on April 13 entered into a contract with the Huntington Light & Power Company to light the streets of the village for a term of five years. The company agrees to furnish 41 street lamps of 20 candle-power at $16.25 per lamp per year.

COOPERSTOWN, N. Y.—The Cooperstown & Cherry Valley Telephone Company has been absorbed by the East Springfield Telephone Company. The business will be continued under the name of the East Springfield Telephone Company, with the following officers: H. P. McDonough, of Cooperstown, president; A. B. Cox, of New York, secretary; Henry Raphbun, of East Springfield, treasurer.

FREDONIA, N. Y.—At a recent town meeting the taxpayers defeated the proposition to issue bonds for $12,000 to pay outstanding indebtedness against the electric light plant, and the waterworks fund. As a result, the trustees, have voted to suspend the operation of the electric light plant.

HART'S ISLAND, N. Y.—Bids will be received until April 30 by John V. Coggey, Commissioner of Correction, New York City, for furnishing material and labor required to run new underground cables for lamps in buildings on the hill, and install a new system of electric wiring for supplying electric light in the several buildings, etc., on Hart's Island.

ROCKVILLE CENTRE, N. Y.—The Village Board of Trustees is contemplating extensive additions to the street lighting system and has instructed W. C. Lott, engineer, to submit estimates for the extension of electric street lighting.

ROME, N. Y.—Bids will be received by the Board of Public Works until May 7 for lighting the city by electricity for five years. The present contract will expire next February.

SHERBURNE, N. Y.—The Oriskany Hydro-Electric Company has secured permission to erect a transmission line through the town of Sherburne and also through North Norwich. The intention of the company is to build a power line to Norwich this summer and to extend the Utica Southern electric railway from Hamilton to this village next year.

WAVERLY, N. Y.—G. Tracy Rogers has sold a controlling interest in the Waverly Electric Light & Power Company to T. M. R. Meikleham, W. B. Dinsmore and R. H. Tingley, of New York.

BRYSON CITY, N. C.—The Bryson City Light & Power Company has secured a franchise to construct an electric light plant. The company is capitalized at $50,000. The incorporators are: P. J. Abbott, J. L. Gibson and others.

WILLIAMSTON, N. C.—Samuel L. Blackburn and associates, of Winston-Salem, have secured a franchise for lighting the streets of Williamston. The new company will be known as the Williamston Light & Power Company.

CASSELTON, N. D.—Extensive improvements are to be made by the North Dakota Independent Telephone Company to its system in this place this spring and summer. The exchange is to be entirely remodeled and a new switchboard and equipment installed.

FARGO, N. D.—The capital stock of the Norwich Telephone Company has been increased from $5,000 to $25,000.

ATHENS, OHIO.—The City Council has passed an ordinance authorizing the Board of Trustees of Public Affairs to expend the sum of $6,000 for improving and increasing the capacity of the municipal electric lighting plant.

COLUMBUS, OHIO.—The Ohio State University has recently placed an order with the Western Electric Company for a 100-kw alternator.

COLUMBUS, OHIO.—The directors of the Board of Public Service on April 15 rejected all bids opened on March 28 for furnishing material and installing additional machinery for the municipal electric light plant and will receive new bids. There will be required one high pressure condensing steam turbine of ample capacity and adapted for driving a direct-connected generator of a rated capacity of 1000 kilowatts under normal load conditions; one 1000-kw turbine type alternator, one exciter set, one 1000-kw surface condenser and accessories, two 300-hp water tube boilers with superheaters, stokers for two 300-hp water tube boilers with the necessary actuating power and machinery, steel coal bins over two 300-hp boilers with capacity of 100 tons, fuel economizer for two 300-hp water-tube boilers, additional switchboard for 1000-kw alternator and exciter, 300 arc lamps of a rated capacity for 2000 candle-power, 6000 ft. ⅜-in. steel rod for mast arms, 5000 ft. 1¼-in. steel pipe for mast arms, extension to switchboard gallery 11 ft. 6 in. wide x 9 ft. long. Edward F. McGuire is secretary.

DELAWARE, OHIO.—The Delaware, Magnetic Springs & Northern Traction Company is contemplating an extension of the local line up the east bank of the Scioto River to Dublin.

FINDLAY, OHIO.—Application has been made to the City Council for a franchise by the promoters of the Cleveland & Indiana Electric Railway to construct its line through this city. C. F. Jackson and A. J. Henry, of Norwalk, and P. W. Ewing, of this city, applied for the franchise.

FINDLAY, OHIO.—The stockholders of the Findlay-Marion Railway & Light Company have voted to increase the capital stock of the company from $250,000 to $1,250,000, and have also ordered a bond issue of the same amount. The entire right of way has been secured from Findlay to Marion, the distance over the route being 47 miles.

LONDON, OHIO.—The citizens have voted to issue $5,000 in bonds for improvements to the municipal electric lighting plant.

MARYSVILLE, OHIO.—Plans are now under consideration for the construction of an electric railway from Marysville to Columbus. P. G. Hankey, of Detroit, Mich., and C. W. Meeker, of Columbus, are interested in the project.

PAULDING, OHIO.—The Board of Public Affairs has purchased the plant of the Paulding Electric Light & Power Company. The price paid for the plant was $7,500.

SPRINGFIELD, OHIO.—The Springfield, Troy & Piqua Railway Company is planning to build a branch line to St. Paris, a distance of about five miles.

SPRINGFIELD, OHIO.—J. J. Finn, president of the Springfield & Southeastern Interurban Railway, has announced that the road has been financed. Work is expected to begin within 90 days.

TOLEDO, OHIO.—Contracts will be placed during the next six weeks by the Toledo & Michigan Electric Railway Company for the construction of about 56 miles of road. A new power house and car houses will also be erected.

URBANA, OHIO.—The Board of Public Service has entered into a contract with the Urbana Light Company for lighting the streets of the city for a term of ten years. The company agrees to furnish 100 lamps at $75 per year each.

EL RENO, OKLA.—The City Council has granted a franchise for a street railway line to Henry Schafer, W. Maney and John Maney.

OKLAHOMA CITY, OKLA.—The Oklahoma Gas & Electric Company is planning extensions to its system of electric lighting.

BANDON, ORE.—Edwin G. Amme, Portland, is president of the Bandon Electric Company, incorporated with a capital of $20,000 to construct an electric light plant in Bandon.

PORTLAND, ORE.—The Portland Light & Power Company has decided to construct a power plant.

ALLEGHENY, PA.—The City Council has granted a franchise to the Federal Street and Pleasant Valley Passenger Railway Company to construct and operate a street railway on certain streets in this city.

COLLEGEVILLE, PA.—A charter will soon be applied for by the promoters of the Perkiomen Valley Traction Company to construct an electric railway from Collegeville through Perkiomen township. The line will be about 11½ miles long. The promoters are: Irvin H. Bardman, Schwenksville; Henry T. Hunsicker, Iron Bridge; Samuel E. Hughes, George Dunn and John H. Dager, of Norristown.

COLUMBIA, PA.—Surveys are now being made and the right of way secured by the Columbia & Manor Electric Railway Company for its proposed line from Columbia to Manor, with a branch from Central Manor to Highville. The road will be 12 miles long. Henry Wertz, of Washington, is president.

ELIZABETHTOWN, PA.—Notice has been given that a charter will be applied for on May 3 by the Deodate & Hershey Street Railway Company to build an electric railway from Elizabethtown to Hockersville. The applicants for the charter are William H. Lebkicher, John E. Snyder, S. C. Stecher, C. S. Maulfair and F. B. Snavely.

MASONTOWN, PA.—Capitalists representing the Smithfield, Masontown & Brownsville Short Line Electric Railway Company are planning the construction of a line running from Smithfield to Uniontown, with branches to Greensboro and to the Sterling Coal & Coke Company's works near Masontown. Another line is also contemplated from Masontown to Brownsville. John C. Short, of New York, N. Y.; C. S. Crawford, of Pittsburg, and W. J. Sheldon, of McKeesport, are interested in the project.

MYERSTOWN, PA.—An electric lighting plant is being installed at Albright College. A 20-hp engine has recently been installed in the power house. In addition to furnishing electricity for lighting the college buildings and grounds the plant will also light the United Evangelical Church.

PHILADELPHIA, PA.—B. C. Batcheller, chief engineer Batcheller Pneumatic Tube Company, writes that bids will be received on or about May 1 for laying about seven miles of 8-in. pneumatic tubes and three miles of electric conduits in this city. Plans and specifications can be obtained at the office of the company.

SCRANTON, PA.—The Commonwealth, the Meshoppen, Auburn, and Sayre & Sullivan County Telephone Companies have been consolidated under the name of the Commonwealth Telephone Company. The company will build exchanges in Meshoppen and in Mehoopany.

SUSQUEHANNA, PA.—The Susquehanna County Electric Company has decided to construct a power plant on the James Mill site at Lanesboro.

YORK, PA.—The New York Telephone & Telegraph Company, of York, Pa., will apply for a charter on April 29 to operate a telephone line in Delaware, Philadelphia and other counties of the State.

MITCHELL, S. D.—The Mitchell Gas Company has filed with the City Council its withdrawal of acceptance of the franchise granted by the Council, claiming that it cannot operate at a gain under its terms. The new franchise calls for a large reduction in the price of incandescent lighting to the citizens and also in arc lamps for the city, aside from paying the city 3 per cent of the gross earnings.

BRISTOL, TENN.—Charles Hansel & Company, of New York, N. Y., are interested in a project to develop the water power of Holston River to generate electricity for lighting and power purposes in Bristol. The plan will involve an expenditure of $600,000. Mr. Hansel has stated that the only guarantee that will be required to bring this development about will be the organization of a company in Bristol that will take the responsibility of distributing electricity to the extent of 3000 horse-power. The Board of Trade is organizing this company, and already more than one-half of the $600,000 stock has been subscribed.

MEMPHIS, TENN.—A franchise has been granted by the City Council to Winfred Wilson and associates to erect and maintain an electric lighting plant in this city.

HOUSTON, TEX.—The Walburg-Weir Telephone Company has increased its capital stock from $4,000 to $7,000.

SHERMAN, TEX.—The North Texas Telephone Company has purchased the plant and system of the Phoenix Telephone & Telegraph Company.

OGDEN, UTAH.—At a recent meeting of the Ogden City Improvement League a committee consisting of W. B. Wedell, J. C. Nye and A. T. Wright was appointed to work in connection with a similar committee appointed by the City Council to secure a municipal electric lighting plant for the city.

FREDERICKSBURG, VA.—The stockholders of the Fredericksburg Water Power Company have purchased land on the Rappahannock River, and also on the Rapidan, from the point where it flows into the Rappahannock, and will build three large dams for storing the water to be used for power in generating electricity. Two of these dams will be built on the Rappahannock and one on the Rapidan. The company has established headquarters in this city, and the engineers are now at work on the project.

RADFORD, VA.—The Radford Water Power Company will erect a new brick fireproof bulding, in which a 200-kw motor-generator set, recently purchased of the Westinghouse Electric & Manufacturing Company, will be installed. It has been stated that about $25,000 will be spent for improvements during the year.

RICHMOND, VA.—The Board of Aldermen on April 17 passed the Dabney ordinance, providing for the construction and operation of an electric light and power plant on the site of the old pumping station, but carrying no appropriation for the same.

RICHMOND, VA.—The Virginia Passenger & Power Company has placed contracts for the following equipment: With Allis-Chalmers Company, for a 3250-kw turbine; with Alberger Condenser Company, for jet condenser for the above turbine; with Babcock & Wilcox Company, for three 600-hp boilers; with Power Specialty Company, for Foster superheaters for the above boilers; with the General Electric Company, for two 1000-kw motor generator sets and four 750-kw transformers and switching apparatus for turbine, motor generators and transformers.

BALLARD, WASH.—The City Council is considering the construction of an electric light plant.

PROSSER, WASH.—The Prosser Falls Land & Power Company has purchased the plant and holdings of the Prosser Electric Company.

SPOKANE, WASH.—F. C. MacGougan, manager of the Pacific Telephone & Telegraph Company, announces that from $500,000 to $750,000

will be expended in Spokane in the betterment of the service. The company has under consideration the erection of a new exchange building.

WAITSBURG, WASH.—The Pacific States Telephone Company has leased the plant and system of the Waitsburg Rural Telephone Company for a term of ten years.

BENWOOD, W. VA.—It is reported that the Ohio Valley Electric Light & Heat Company is contemplating extensive improvements and practically putting in a new plant.

BANGOR, WIS.—The Bangor Telephone Company has filed an amendment to its articles of incorporation increasing its capital stock from $5,000 to $25,000.

EMPIRE, WIS.—The Empire Telephone Company has increased its capital stock from $1,800 to $4,000.

KAUKAUNA, WIS.—The Green Bay & Mississippi Canal Company has decided to rebuild the lower half of the canal waterway and construct a power house at the foot of the canal; the additional power, it is said, will be used by an electric interurban line about to be built into Kaukauna from Milwaukee.

KENOSHA, WIS.—A. S. Higley is president of a company which proposes constructing an electric light plant in the western part of Kenosha County to light the towns of Bristol and Salem. The probable cost of the plant will be about $40,000.

LIBERTY, WIS.—The capital stock of the Liberty-Newton Telephone Company has been increased from $1,400 to $3,000.

MILWAUKEE, WIS.—The Keelyn Electric Company has decided to increase its capital stock from $15,000 to $25,000.

MILWAUKEE, WIS.—The capital stock of the North Milwaukee Light & Power Company has been increased from $5,000 to $12,000.

MILWAUKEE, WIS.—The committee on street lighting has recommended the City Council to enter into a contract with the Milwaukee Electric Railway & Light Company for lighting the city for a term of five years, dating from December 10, 1905, at the rate of $65 per lamp per year.

WAUKESHA, WIS.—The Shields Telephone Company has been incorporated, with a capital stock of $5,000, by C. E. Pierce, J. A. Shalow, G. W. G. Grahn and others.

CHEYENNE, WYO.—The Klondike Telephone Company has been incorporated, with a capital stock of $1,000. E. A. Moeller is president.

CALGARY, ALB.—The City Council has voted in favor of installing a municipal telephone system. About 4000 telephones will be required. Address Mayor Cameron.

CALGARY, ALB.—The rate payers have passed a by-law to provide $35,000 for extensions to the electric lighting plant. Address City Engineer Thorold.

VANCOUVER, B. C.—W. V. Hunt, of the British Columbia Electric Railway Company, has been appointed engineer in charge of the work of installing the new water power units at Lake Buntington. Three units of 10,000 horse-power each will be added, at a cost of $250,000. The work will be completed in about nine months. R. N. Sperling is general manager.

EDMONTON, CAN.—Contracts have been placed by the city with the Allis-Chalmers Company and the Power & Mining Company, of Milwaukee, Wis., for a 1000-hp gas-engine unit for the municipal power plant. This will be an extension of the present steam power plant. The machinery will be installed this summer under the direction of R. R. Keely, city engineer, and will furnish electricity for the municipal lighting and power system, and for operating the municipal railway system now under construction and also for the electric pumps of the water department.

FORT SASKATCHEWAN, CAN.—The Alberta government has taken over the telephone system here and will operate it under municipal ownership. Address W. H. Cushing, minister of works, Calgary, Alb.

MEDICINE HAT, CAN.—The Council has voted in favor of a municipal telephone system and will issue debentures to pay for the same. Address F. G. Forster.

BRANDON, MAN.—The City Council has voted in favor of a municipal telephone system.

RATHWELL, MAN.—The municipality of South Norfolk has decided to build a rural telephone system. Address Adam Forbes, Rathwell, Man.

ROULEAU, MAN.—The installation of an electric power plant in this place is under consideration.

VIRDEN, MAN.—The Town Council has voted in favor of the installation of a municipal telephone system. Address A. G. MacDougall.

BERLIN, ONT.—The by-law providing for the purchase of the Berlin & Waterloo Street Railway system by the city has been carried by the ratepayers. The purchase price is $75,200, and debentures for this amount will be issued shortly.

OTTAWA, ONT.—The Hull Power Company on April 17 gave the city final notice of one month that it intends to cancel its agreement with the city for supplying electricity to the municipal electric plant. The city has not yet closed its arrangements with the Ontario Hydro-Electric Power Commission for a supply of power.

STIRLING, ONT.—The Stirling Telephone Company, Ltd., has been incorporated with a capital stock of $10,000.

TORONTO, ONT.—The city of Toronto has decided not to expropriate the plant of the Toronto Electric Light Company, as it could not accept the terms proposed by the committee. A special clause has been inserted in the city's bill which gives the city the right to enter into a contract with the Hydro-Electric Power Commission and to establish an independent distributing plant of its own.

CAMPECHE, MEX.—L. B. Spyer & Company, of Mexico City, have signed a contract with Governor Tomas Anzar y Cano, of the state of Campeche and the City Council of Campeche for the installation of an electric light and power plant in this city. A subsidiary company will be organized to carry out the terms of the concession.

MONTEREY, MEX.—Indalecio Trevino, of Monterey, and associates, are arranging to install an electric power plant on the Escondidio River in the state of Coahuila. The electricity will be transmitted to industries in that section.

ORIZABA, MEX.—The Compania Industrial de Orizaba is installing another hydro-electric plant on the Blanco River, near the city of Orizaba.

PARRAL, MEX.—The Parral Power & Reduction Company is preparing to construct an electric street railway system in the city of Parral. R. B. Davis, formerly superintendent of construction of the Mexican Tramways Company, Ltd., of Mexico City, has completed an estimate of the cost of the proposed system.

PACHUCA, MEX.—At a meeting of the stockholders of the Electric Power Transmission Company of the State of Hidalgo, held recently, it was decided to acquire two more waterfalls, to erect additional hydro-electric plants and to increase the capital stock of the company $759,600.

TORREON, MEX.—The Canadian syndicate has forfeited its option to purchase the electric lines of the Consolidated Street Railway Company, of Torreon. The latter company has taken steps to extend the lines and to make important improvements.

New Industrial Companies.

THE AMERICAN LIGHT & FIXTURE COMPANY, of Chicago, Ill., has been chartered with a capital stock of $5,000 by Franz Isole and Otto Rhein. The company proposes to manufacture gas and electric fixtures.

THE A. H. BUSCHMANN COMPANY (electrical contractors) of New York, N. Y., has been incorporated with a capital stock of $5,000. The directors are A. H. Buschmann, Long Island City; J. L. Bunze and Fernand Beck, of New York, N. Y.

THE GUMMON ELECTRIC & INSULATION COMPANY, of Northport, N. Y., has been incorporated with a capital stock of $250,000. The directors are James Gillin, D. W. Troy and W. L. Morris, of New York, N. Y.

THE KENT MANUFACTURING COMPANY, of Brookline, Mass., has been incorporated with a capital stock of $75,000 for the purpose of doing electrical work. The incorporators are Edwin N. Kent, William P. Minor, and Forrest F. Collier.

THE OHIO NOVELTY SIGN & ELECTRIC COMPANY, of Marion, Ohio, has been incorporated with a capital stock of $10,000 by L. B. McNeal and others.

THE RAILWAY TRACTION CONSTRUCTION COMPANY, of New York, N. Y., has been incorporated with a capital stock of $100,000. The directors are M. A. Schenck, Robert Gebracht, Jr., and G. H. Fitzgerald, Brooklyn, N. Y.

THE TELEGRAPHONE DISTRIBUTING COMPANY, of New York, N. Y., has been incorporated with a capital stock of $5,000. The directors are L. J. Kersberg, Isadore Miner and Hyman Epstein, New York, N. Y.

THE WARREN ELECTRICAL COMPANY, of Brooklyn, N. Y., has been incorporated with a capital stock of $6,000 and the following directors: G. L. Warren, F. E. Kneeland, Jr., Brooklyn, and G. S. Burr, Hackensack, N. J.

Legal.

HUDSON RIVER POWER.—The Appellate Division of the New York Supreme Court has handed down a decision in the case of the National Contracting Company against the Hudson River Water Power Company, upholding the finding of Referee Alton B. Parker in favor of the defendant. By this decision the judgment dismissing the plaintiff's complaint is unanimously affirmed, and a counter-claim of $287,253 against the National Contracting Company is awarded to the Hudson River Water Power Company.

STREET RAILWAY COMPANY NOT ABSOLUTELY LIABLE TO PERSON RECEIVING A SHOCK UPON STEPPING ON TRACKS.—In an action against a street railway company to recover damages for injuries which resulted from an electrical shock received by the plaintiff upon stepping on the defendant's tracks the learned counsel for the plaintiff, at the close of the case, asked the court to instruct the jury that if they believed that the plaintiff received the injuries at the

time and in the manner alleged they might bring in a verdict for the plaintiff, unless they were satisfied that the defendant company had exonerated itself. The court replied: "Whether the defendant exonerated itself or not, if they believe he received an electrical shock he is entitled to recover." It was held on appeal that the charge given was erroneous in that it made the defendant out to be an insurer against accidents of this kind and a judgment in favor of the plaintiff was, for this reason, reversed. Sullivan vs. Brooklyn Heights Railroad Company, New York Supreme Court, Appellate Division, 102 N. Y. Supp. 982.

ADMISSION OF TELEPHONE CONVERSATION IN EVIDENCE.—Where the cashier of a bank calls up a business house on the telephone, asking to be put in communication with the head of the concern, and a question as to whether certain drafts would be paid is answered in the affirmative, the statement is admissible in evidence in an action thereafter brought to recover upon the drafts, although the cashier did not recognize and could not identify the person with whom he talked. When a person places himself in connection with a telephone system through an instrument in his office, he thereby invites communication, in relation to his business, through that channel. Conversations so held are as admissible in evidence as personal interviews by a customer with an unknown clerk in charge of an ordinary shop would be in relation to the business there carried on. The fact that the voice at the telephone is not identified does not render the conversation inadmissible, but the weight to be given such a conversation is determined by the jury. Goodair vs. Ham. National Bank, Supreme Court of Illinois, 80 N. E. Rep. 407.

AUTHORITY OF BOARD OF HEALTH TO DECLARE POWER HOUSE A NUISANCE IS NOT CONCLUSIVE.—Section 21 of the public health law (Laws of New York, 1893, chap. 661, p. 1502) empowers local boards of health to make and publish general orders and regulations for the preservation of life and health, and also orders and regulations not of general application for the suppression of particular nuisances, and to maintain suits in the name of the municipality to restrain by injunction violations of such orders. In an action by the Village of White Plains against the Tarrytown, White Plains & Mamaroneck Railway Company, the complaint alleged that the board of health of the village, after a hearing to the defendant, passed a resolution declaring the vibrations of its engines and dynamos in its electrical power house a nuisance and a cause of danger and detrimental to the health of a large number of inhabitants of the village, and ordering it abated. The complaint was held to be defective for not alleging any fact tending to show a nuisance, such, for instance, as noise or jar extending beyond the power house. The mere fact that the board of health had declared the power house to be a nuisance did not make it such. Village of White Plains vs. Tarrytown, etc., Railway Company, New York Supreme Court, Appellate Division, 102 N. Y. Supp. 1046.

FRANCHISE OF FRANKFORT TELEPHONE COMPANY DECLARED INVALID.—Section 164 of the Constitution of the State of Kentucky provides that, before giving a franchise or privilege for a term of years, a city shall first, after due advertisement, receive bids therefor publicly and award the same to the highest bidder. The city of Frankfort granted a franchise to the Frankfort Telephone Company to erect its lines in the public streets of the city, without observing the preliminaries required by the constitutional provision referred to. In an action by the telephone company to enjoin the Common Council of the city of Frankfort from enforcing an ordinance regulating the telephone rates, on the ground that the rates were so low that the business could be conducted only at a loss, the question arose as to whether or not the company had a valid franchise. It was conceded by the company's counsel that, in order to grant a valid franchise for a term of years, it was necessary that the privilege be sold at public auction to the highest bidder. But it was insisted that the city had not bound itself to continue the franchise of the Frankfort Telephone Company for more than a year and that section 164 does not require a franchise for less than a term of years to be sold in order to be valid. But it was held that such a construction would render the section vain and illusory. The franchise, not having been sold as directed in section 164, was invalid and, having no franchise, the telephone company could not be heard to complain of the establishment of rates which prohibited it from doing business. Frankfort Telephone Company vs. Common Council, Court of Appeals of Kentucky, 100 S. W. Rep. 310.

CARE REQUIRED OF TELEPHONE COMPANY IN PROTECTING OTHERS FROM INJURY.—The Gainesboro Telephone Company operates a telephone system in Somerset, Ky., and maintains a pay station at the Newtonian Hotel. Frank J. Brucker, while a guest at the hotel, was using the pay station to communicate with a party out of town. The phone did not seem to work well and he took hold of the metal arm with his hand to raise the mouthpiece. As he did this he received a severe shock of electricity which knocked him to the floor, rendering him unconscious and injuring his nerves. The voltage of the telephone system was not sufficient to hurt any one and the cause of the accident was not in any way explained. In an action for damages it was held that the telephone company was not liable. Those handling electricity where the voltage is such as to endanger human life must exercise a very high degree of care for the safety of others, but where a less voltage is used, which is not of itself dangerous, the company or person using it is bound to exercise only ordinary care. A telephone company is a common carrier of messages, not of persons. The duty it owes to a customer using one of its instruments is not different from that due to their customers by other persons inviting the public upon their premises for the transaction of business. In all such cases the person so inviting the public is not an insurer, but must use such care as may be reasonably be expected under the circumstances. The plaintiff offered to show by a witness that a short time prior to his injury the witness, in using another phone in the city, received a severe shock of electricity, but this testimony was rejected, as the condition of another phone at another time was entirely collateral to the question of the plaintiff's right to recover. Brucker vs. Gainsboro Telephone Company, Court of Appeals of Kentucky, 100 S. W. 240.

ACTION AGAINST ELECTRIC LIGHTING COMPANY FOR INJURIES RESULTING FROM SHOCK.—The plaintiff in an action against an electric lighting company kept an apothecary store in the city of Lowell, Mass., which was lighted by electricity furnished by the defendant company. The plaintiff employed an electrical contractor to make an extension on his wiring and the wiring was accordingly carried into the cellar of the store and extended in the form of a portable or flexible stranded covered wire cord to which was attached a socket for an incandescent lamp. There was no fuse on any part of the extension thus made, nor any fuse between this extension and the wiring inside of the store. No notice was ever given to the defendant of the plaintiff's intention to make the extension, nor was permission asked of the city wire inspector before making it, but the plaintiff testified, that, after the extension was made, he went to the defendant's office, told the clerk about it and requested a bulb, and that thereafter a man came from the defendant light company and attached the bulb. A few months later the plaintiff went into his cellar and took hold of the flexible cord in such manner that a part of the cord and a part of the lamp socket were in his hand. As a result he received a shock which inflicted severe injury and necessitated the amputation of several fingers. It appeared that an ordinance of the city of Lowell provided that no person should change the position of, nor make any additions to, any wiring system, nor install any new work or electrical apparatus without first notifying the city inspector and obtaining his approval. But the inspector was permitted to testify that in a case like this, where wires were already in place and there was simply an extension made, it was not his practice to require a permit to be obtained before turning on the current, and that in the majority of cases where the work was exposed he did not even examine the premises. This evidence was introduced for the purpose of excusing the plaintiff for not having obtained a proper permit before having the work done. A judgment in favor of the plaintiff was reversed on appeal for the reason that the inspector should not have been allowed so to testify. The methods which he claimed to have adopted were clearly contrary to the ordinance, and were unlawful, and the jury should not have been allowed to speculate upon the question whether the inspector, if he had received a proper notice from the plaintiff, would have neglected to perform his duty. Brunelle vs. Electric Light Corporation, Supreme Judicial Court of Massachusetts, 80 N. E. Rep. 466.

Personal.

MR. P. E. HART, of the Allis-Chalmers-Bullock Company, has been appointed superintendent of telephones and electric lighting in Kenora, Ont.

MR. W. D. MYERS has resigned as superintendent of the Redfield, S. D., municipal plant to become manager with the Western Timber & Mining Company, the main office of which is at Redfield.

MR. HARRY C. GOLDRICK, formerly Southern sales manager for the Kellogg Switchboard & Supply Company, is now in charge of the Canadian office of that company, located at Winnipeg, Manitoba.

MR. C. N. JELIFFE.—Mr. C. N. Jeliffe, formerly auditor of the American Light & Traction Company, has been elected secretary of the company to succeed James Lawrence, who in turn succeeds Mr. Jeliffe as auditor.

MR. N. G. KENAN, president of the Union Gas & Electric Company, of Cincinnati, O., has returned home after a six weeks' trip in the West Indies. He was given a reception by the officials of the corporation and many friends.

MR. J. S. WATSON, manager of the Link-Belt Company's drive-chain department sailed for Europe via the Hamburg-American Line steamship "Amerika" on April 25. While abroad Mr. Watson will visit the chain-making plant of Hans Renold, at Manchester, England.

MR. J. A. VAUGHAN has resigned as manager of the Southern Electric Company, Baltimore, Md., to become manager of the H. C. Roberts Electric Supply Company, Philadelphia, Pa. Mr. Vaughan will assume his new duties on May 1, and his many friends in the electrical field wish him every success.

DR. W. M. HABRISHAW, of the India Rubber & Gutta Percha Insulating Company, sailed on the Cunarder "Campania" on April 20 from New York for Liverpool, to be gone about a couple of months. The trip is wholly for rest and recreation. A large part of the time will be spent in England.

E. WILLIAM TRINKS, formerly of Messrs. Lorenz & Company, telegraph and telephone works, Berlin, has been appointed consulting electrical engineer to F. Z. Maguire, 10 Wall Street, New York, and

will have charge of various examinations and reports on electrical matters connected with the concern.

PROF. F. G. WREN.—It is announced that Prof. Frank G. Wren, Walker Professor of Mathematics at Tufts College, has been appointed by the trustees Dean of the Faculty of Arts and Sciences and of the Faculty of the College of Letters. He will succeed Dean Shipman. He is one of the youngest men in the faculty.

MR. JAMES K. LOGAN, government superintendent of electric lines, Wellington, New Zealand, and honorary secretary there for the British Institution of Electrical Engineers, is visiting New York City and is staying at the Murray Hill Hotel. He is studying closely telegraphic and telephonic development in the United States.

MR. J. F. JACOBI.—As the result of a competitive examination recently conducted, J. Frank Jacobi, of Annapolis, has been appointed foreman of the power plant at the Naval Academy to fill the vacancy caused by the death of Hugh McCusker. Mr. Jacobi was formerly chief electrician at the academy. Two other persons took the examination.

DR. A. G. BELL, after receiving the John Fritz gold medal at the dedication of the Engineering Societies Building last week, sailed immediately for England, to receive the degree of Doctor of Science from Oxford University on May 2. He will then spend a little time in England and Scotland and be the guest, it is understood, of Mr. Andrew Carnegie at Skibo Castle.

MR. I. N. MILLER, Jr., of San Francisco, Cal., who has been superintendent of the first district of the Pacific Division of the Western Union Telegraph Company, has been appointed assistant general superintendent of the Pacific division. Adolph H. May, who has been manager of the Western Union at Salt Lake City, Utah, has been promoted to the position of superintendent of the first district.

MR. W. A. SHENSTONE.—The latest discoveries and conclusions relative to "Electric Waves and Wireless Telegraphy" are described by W. A. Shenstone, in an article which *The Living Age* for April 20 reprints from the *Cornhill* in a manner to be easily understood by the ordinary reader. Mr. Shenstone is a recognized adept in conveying scientific knowledge in a popular way, yet without the air of painful condescension often affected in such articles.

SIR W. H. PREECE, K. C. B., F. R. S., who has been attending the dedication of the Carnegie Institute, the Peace Congress and the opening of the Engineering Societies Building, sailed for England on the Cunarder "Carmania" on April 23, glad "to rest up after being nearly killed with kindness," but otherwise well and hearty. During his stay here Sir William has made good use of his time, being entertained by officials of the New York Edison Company, New York Telephone Company, New York Central Railroad, Interborough-Metropolitan Company, Western Union Telegraph Company, Commercial Cable Company, McGraw Publishing Company and others. The day before sailing he visited the plant of the telharmonium and the new Engineers' Club. It is hoped that Sir William will return at an early date.

MR. E. M. CARNEY.—The Lawrence, Mass., Telegram says: "Edward M. Carney, of Sheridan Street, leaves for Savannah, Ga., to take charge of a general publicity campaign for Stone & Webster, a firm which owns and controls electric railways and electric lighting plants all over the United States. He will be in the South about a year, and will then return to the Boston office. In the fall, Mr. Carney will be joined by his wife and son, who will spend the winter in Georgia and Florida. Mr. Carney has had an experience which well fits him for his responsible duties. His first training in newspaper work on the Telegram was supplemented by valuable experience as resident manager of the Equitable Life, and he goes to his new field remarkably well equipped. His many friends in Lawrence wish him all kinds of success and look forward to a brilliant career for him."

MR. CHARLES F. BOYNTON, for the past 13 years connected with the Department of Water Supply, Gas and Electricity, New York, has resigned his position as chief inspector, Electrical Bureau, to accept the position of assistant manager of the New York office of the National Metal Molding Company, manufacturers of "Flexduct" and "Economy" conduits. Mr. Boynton upon retiring from his former position was tendered a farewell dinner by his recent associates and was presented by them on the occasion with a handsome pair of cuff buttons and a beautiful diamond pin. Mr. Boynton through his extensive acquaintance in the electrical field will prove a valuable addition to the already able staff of the National Metal Molding Company.

MR. F. JOHNSON has resigned from the sales organization of the General Electric Company, St. Lous office, and has accepted the position of St. Louis district manager of the Wagner Electric Manufacturing Company. Mr. Johnson has been associated with electrical matters in St. Louis for eight years, having been connected with the sales organizations of the General Incandescent Arc Light Company and the Stanley G. I. Company prior to its absorption by the General Electric Company. Mr. Johnson will be located in the new offices in the Frisco Building recently opened by the Wagner Electric Manufacturing Company to handle its St. Louis territory, as a result of the removal of its factory to large new works in the outskirts of that city.

MR. B. CARROLL SHIPMAN, late erecting engineer for the Westinghouse Electric & Manufacturing Company, has resigned to open a consulting office in San Francisco. He has located in the Atlas Building, 604 Mission Street. After graduation from Georgetown University in 1892, his early training was secured in the shops of the Westinghouse Electric & Manufacturing Company, before they were moved to East Pittsburg. He was later electrical inspector of the city of Washington, D. C., and left that position to take up work with the Lorain Steel Company, where he was in charge of their electric track welding equipments in the field. While with them, he redesigned some features of these equipments, materially reducing the amount of apparatus required. In 1900 he returned to the Westinghouse interests as an erecting engineer. Since then he has been in charge of the erection work of some well known installations, notably the Shawinigan Water & Power, 50,000-volt transmission, and the Montreal Light, Heat & Power, 25,000-volt transmission. He was later district engineer for the same company at Baltimore, Md., for two years, having charge of all of their erecting work throughout Maryland, Virginia, West Virginia and parts of Tennessee and North Carolina. More recently he had charge of the erecting work for his company of the 70,000-volt installation for the Helena Power Transmission Company at Butte, Anaconda and Hauserlake. Mr. Shipman will give especial attention to the high tension transmission of power, for which his considerable experience has qualified him.

Business Notes.

THE CLEVELAND GAS & ELECTRIC FIXTURE COMPANY has changed its location from Cleveland to Ashtabula, Ohio.

THE ROBB-MUMFORD BOILER COMPANY has moved its New York office from 11 West Broadway to the West Street Building, 90 West Street.

THE ELECTRIC STORAGE BATTERY COMPANY has moved its sales offices from Oakland, Cal., to San Francisco, and will temporarily occupy offices at 11 Hawthorne Street, at which place all business will receive attention.

THE HAYS ELECTRIC MANUFACTURING COMPANY, of Indianapolis, Ind., has established a plant in the new Industrial Building to manufacture automatic electric flashers, for street and building signs and other electrical devices.

THE CONNECTICUT TELEPHONE & ELECTRIC COMPANY, of Meriden, Conn., has decided to enlarge its plant on Britannia Street and with this object in view has purchased property adjoining the present shop. It is the intention to build a large brick factory on the newly acquired land.

THE NATIONAL CARBON COMPANY, Cleveland, O., is meeting with great success on its carbons for flaming arc lamps, which it has put on the market during the past year. The large number of orders which it is constantly booking for these carbons is very satisfactory proof of their popularity.

THE WYCKOFF PIPE CREOSOTING COMPANY, of Stamford, Conn., is furnishing a number of the Bell Telephone companies with their underground conduit and creosoted lumber. It has references from places where its conduit has been underground for 23 years, showing no sign of decay. It is claimed to be the cheapest conduit to lay, smooth inside, and it does not rip the cables in being drawn in.

BLAKE SIGNAL.—The Blake Signal & Manufacturing Company, 246 Summer Street, Boston, Mass., has established the following agencies for its Blake tube flux: George F. Schoen, 108 S. Forsyth Street, Atlanta, Ga.; Sayles R. Fralick, 269 South Canal Street, Chicago; Wesco Supply Company, St. Louis; Brooks-Follie Electric Corporation, 212 First Street, San Francisco, and Norton-System Telephone Company, Toronto, Can.

THE OHIO BRASS COMPANY, Mansfield, O., announces that it has made preparations to greatly increase its facilities for manufacturing high-potential line insulators, and is now in a position where companies contemplating the building of transmission systems may call on it for complete specifications and engineering data, and is now prepared to submit plans covering all requirements of climatic conditions and high voltages. Its factory is well located from a manufacturing standpoint, having ample shipping facilities as well as the ability to secure skilled labor of the kind required.

THE GREEN FUEL ECONOMIZER COMPANY has found it necessary to remove its Chicago office from the Monadnock Block to the Old Colony Building, in order to secure more room. This company has been especially active in mechanichal draft work for boiler plants, having recently installed some of the largest over-hung wheels ever built, notably the 18 ft. 6 in. x 6 ft. wheels supplied to the Grand Rapids Railway Company, and the 19 ft. 6 in. x 7 ft. wheel installed for the St. Louis & Suburban Railway. Mechanical draft and fuel economizers are frequently put in together because they are beneficial under similar conditions, and are complementary in promoting fuel economy, each helping the other in the saving of coal. The mechanical draft outfit makes it possible to utilize the economizer to the fullest extent; to burn the cheapest grades of fuel; to handle heavy, sudden overloads on the boilers; to get along with fewer boilers; to dispense with expensive chimneys; to obtain all the draft wanted in all conditions of weather and to secure more thorough combustion. Besides mechanical draft work, the Green people are doing a large business in heating and ventilating apparatus and in artificial drying outfits for brick yards, wood-working plants, paper mills and other industrial establishments.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED APRIL 16, 1907.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys, 41 Park Row, N. Y.]

850,127. ELECTROLYTIC APPARATUS; Anson G. Betts, Troy, N. Y. App. filed May 11, 1904. In an electrolytic apparatus, the combination with a vat or tank; an electrolyte containing an oxidizable ingredient of insoluble anodes and means for imparting to the anodes a reciprocating movement through the electrolyte.

850,129. PORTABLE ELECTRIC MEASURING INSTRUMENT; Henri Bourgeois, Damprichard, France. App. filed July 31, 1905. A combined voltmeter and ammeter of the type resembling a watch case. Has a small spring reel on which is wound a flexible conductor which may be drawn outward through a hole in the casing when a connection is to be made.

850,165. ELECTRIC MOTOR-STARTING DEVICE; David R. Knapp, Philadelphia, and Howard E. Cade, Pencoyd, Pa. App. filed Dec. 7, 1906. An automatic means for starting an electric motor after power has been supplied to the same through a resistance. Covers detail features of a system of contractors, the magnets of each of which is differentially wound.

850,166. ELECTRICAL CONDENSER AND METHOD OF MAKING THE SAME; Robert C. Lanphier, Springfield, Ill. App. filed Dec. 13, 1905. The method of insulating a condenser which consists in first thoroughly drying the same and then immersing it in a bath of sulphur heated to the point at which the sulphur becomes a thin liquid.

850,173. ELECTRIC TRANSPORTATION SYSTEM; William C. McMurray, Wellsville, Ohio. App. filed Nov. 20, 1905. A telpherage line having two trolley wires or cables which carry entirely separate trucks of the car. The circuit is made through the motors from one truck to the other.

850,203. ELECTRIC MOTOR; Ralph E. Barker, Lynn, Mass. App. filed March 12, 1906. In combination with an electric motor, an impedance normally in series with said motor, and automatic means for short-circuiting said impedance at starting.

850,205. AUTOMATIC DEVICE FOR INDUCTION-MOTORS; Sven R. Bergman, Lynn, Mass. App. filed March 20, 1906. In combination with a single-phase induction-motor having a three-phase winding and different connections for starting and for running a switch controlling said connections, and a magnet-winding controlling said switch and connected between the motor-terminal not connected to the source and a neutral point.

850,211. AUTOMATIC MOTOR CUT OUT; Frank E. Case, Schenectady, N. Y. App. filed July 18, 1906. Relates to the connections of the motors in electric locomotives where four motors are used in separate pairs. Has means whereby the blowing of a fuse in one motor automatically affects the cutting out of the motor of the other corresponding group or groups.

850,217. SYSTEM OF DISTRIBUTION; Budd Frankenfield, Norwood, Ohio. App. filed March 17, 1906. In a system of distribution, a main source of current supply or feed-conductors, a dynamo-electric-machine unit comprising two armature windings and a generator-armature winding having shunt field excitation, and one or more shunt field-windings, and a separate generator having a series field-winding and an armature-winding in series with one of the other windings.

850,218. SYSTEM OF DISTRIBUTION; Budd Frankenfield, Norwood, Ohio. App. filed March 31, 1906. In a multiple-voltage system of distribution, a plurality of conductors comprising main and neutral or compensating conductors, a balancer comprising armature-windings, and means comprising conductors and interlocked switches for connecting the windings to said main and compensating conductor.

850,231. TELEGRAPHY; Isidore Kitsee, Philadelphia, Pa. App. filed April 24, 1906. Relates to a system of submarine telegraphy in which a plurality of batteries at each station of the line are made unnecessary, although the transmission is by the method of currents of opposite polarity.

850,237. BRUSH HOLDER; John P. Mallett and Thomas E. Drohan, Madison, Wis. App. filed May 10, 1901. Has a stud on which a brush-carrying frame is loosely mounted, a member rigidly secured to the stud and extending between the arms of the frame and supporting a U-shaped spring which engages the brush-carrying frame.

850,258. CIRCUIT DETECTING DEVICE; Louis M. Schmidt, Lynn, Mass. App. filed Oct. 8, 1904. A laminated V-shaped core having divergent legs carries a winding and is adapted to be positioned on conductors of different sizes.

850,270. VAPOR ELECTRIC APPARATUS; Charles P. Steinmetz, Schenectady, N. Y. App. filed Oct. 17, 1904. A means for initially heating mercury vapor lamps so that they will start easily in cold weather. Has a heating coil which surrounds the tube at the base thereof where the mercury is contained.

850,276. DYNAMO-ELECTRIC MACHINE; Karl Sulzberger, Berlin, Germany. App. filed April 3, 1906. In a dynamo-electric machine of the commutator type, a field structure provided with a compensating and commutating winding, the commutating portions of the winding for the several poles of the machine being connected in a group and the remaining portions of the winding being connected in another group.

850,277. SYSTEM OF MOTOR CONTROL; Clifford R. Tatem, Buffalo, N. Y. App. filed March 31, 1906. Relates to the construction of a starting controller for motors of large capacity in which the controller is designed to be either automatically or manually operated, and to reduce to a minimum the loss of energy in the starting apparatus. First supplies an alternating current motor with current at reduced voltage and later current of full voltage from the line.

850,278. SYSTEM OF DISTRIBUTION; Lewis L. Tatum, Norwood, Ohio. App. filed March 31, 1906. Relates to multiple voltage systems of distribution having any number of feeder conductors and circuits. Provides means whereby compound wound dynamo electric machines can be employed in balancers for multiple voltage systems with less danger of the balancers racing on unbalanced loads.

850,279. CUT-OUT FOR VAPOR ELECTRIC APPARATUS; Tycho Van Aller, Schenectady, N. Y. App. filed Oct. 12, 1904. Has a thermostat in close proximity to a special heating coil and the movement of the thermostat arm when warmed, trips a circuit-breaking lever. Is intended to cut the lamp out of circuit in case it fails to start within a reasonable time.

850,287. COMBINED FIRE AND BURGLAR ALARM; Alexander M. Bennett, Ellsworth, Mich. App. filed April 18, 1906. A circuit-closing device which is adapted to be operated by a cord or wire extending therefrom across the windows and doors to be protected, so that any disturbance pulls the wire and closes the alarm circuit.

850,305. DUPLEXING TELEGRAPH LINES;; Isidor Kitsee, Philadelphia, Pa. App. filed Aug. 9, 1906. Relates to duplex telegraphy on submarine cables in which the usual balancing resistance and capacity are dispensed with, thereby avoiding the expense and the continual necessity of readjusting the balance incident to the ordinary systems.

850,311. ANNUNCIATOR; James L. McQuarrie, New York, N. Y. App. filed Oct. 2, 1905. An annunciator of the telephone drop signal type having a pair of spring blades normally held separated by the armature of an electromagnet but which contact to close a local circuit when the armature is attracted.

850,329. ELECTRIC AND PNEUMATIC GOVERNOR; Harry W. Young, Philadelphia, Pa. App. filed Jan. 27, 1906. A pneumatic device for controlling the switches of an electric motor which operates an air compressor system. In case the pressure falls below a predetermined amount certain detents are released which permit movement of the switch arms under the influence of pneumatic cylinders.

850,334. AUTOMATIC CUT-OUT OR FUSE-BOX; Swan C. Anderson, Oak Park, and Charles H. Frenberg, Chicago, Ill. App. filed Oct. 18, 1906. In order to widely separate the fuse terminals immediately when the fuse is blown, patentee has the terminals on spring-impelled arms which are held in alignment by the tension of the fuse wire, but which move into separate position when this tension is removed.

850,344. TELEPHONE-EXCHANGE SYSTEM; Edward E. Clement, Washington, D. C. App. filed March 20, 1905. Relates to details of circuits of a system having a plurality of subscribers' lines and substations and a central switchboard for interconnecting the same, arranged in several divisions or parts.

850,364. KEYBOARD TELEGRAPH TRANSMITTER; George M. Goddard, Rutland, Vt. App. filed April 30, 1906. Has a constantly rotating shaft with separate commutator disks thereon corresponding to the separate letters. These are independently clutched to rotate with the shaft by the depression of any particular key.

850,365. ALARM FUSE; William E. Harkness, Chicago, Ill. App. filed Feb. 24, 1906. A thermal cut-out device for a telephone circuit having two plates of sheet metal bound together in insulating relation and having spring tongues between which the fuse wire is stretched.

850,367. BATH CABINET; John Hermann, Saginaw, Mich. App. filed March 29, 1906. Relates to bath cabinets of the type having incandescent lamps. Covers details of construction by which the walls are made of a double thickness of plate glass with water-tight joints or seams.

850,376. PROCESS OF PRODUCING LIGHT METALS BY ELECTROLYSIS; Franz von Kugelgen and George O. Seward, Holcombs Rock, Va. App. filed May 4, 1905. The process of producing light metals from their salts, which consists in electrolyzing the fused salt in the presence of a soluble anode of heavy metal beneath and a cathode above, thereby forming a salt of the heavy metal and drawing off the latter salt periodically to keep its level remote from the cathode.

850,392. PROCESS OF OXIDIZING ATMOSPHERIC NITROGEN; Albert Neuburger, Berlin, Germany. App. filed Dec. 24, 1904. The process of oxidizing nitrogen which consists in subjecting a mixture of nitrogen and oxygen to the action of an electric arc employing a maximum energy of 120 watts.

850,402. RELAY; Charles E. Scribner, Jericho, Vt. App. filed March 31, 1906. A telephone relay of the type having all the parts stamped of sheet metal. The armature is supported on one pole of the electromagnet by a knife blade pivotal connection so as to move without resistance in spite of the magnetic flux.

850,412. AUTOMATIC FLUID PRESSURE AND MOTOR CONTROLLER; Walter J. Bell, Los Angeles, Cal. App. filed June 3, 1905. A motor controller of the type adapted to close the motor circuit in case the pressure in a reservoir falls below a predetermined amount. Has a cylinder the piston of which is weighted and which has a link connection with the switch arm to close the same when the pressure falls.

850,433. TELEPHONE APPARATUS; Koby Kohn, New York, N. Y. App. filed Oct. 24, 1906. In a telephone system, the combination with the main-line wires, of a series of telephone-receivers each independently connected to said wires by an open electric circuit, a generator adjacent to each receiver, and means operated by each generator for closing its receiver-circuit and preventing the closure of all the other receiver-circuits, substantially as set forth.

850,434. TELEPHONE APPARATUS; Koby Kohn, New York, N. Y. App. filed Feb. 11, 1904. Relates to modifications of the above.

850,443. MOTOR CONTROLLER; Adolph Pedersen, Cleveland, Ohio. App. filed Aug. 16, 1905. Controller for small motors such as are used for electric drills. Has manual means by which the circuit closing arm is caused to move abruptly into circuit closing and circuit opening relation and automatic means by which the circuit is opened in case the current exceeds a predetermined value.

850,470. TELEPHONE TRUNKING SYSTEM; William W. Dean, Chicago, Ill. App. filed July 16, 1902. Diagram of cord circuits, etc., of a central exchange.

850,475. ELECTRIC MOTOR AND CONTROLLER FOR THE SAME; John H. Hertner, Cleveland, Ohio. App. filed May 23, 1906. A special system of controlling motors having shunt and series windings adapted for use with motor vehicles. Introduces a shunt to oppose the series windings and varies the number of the series turns by the controller.

850,484. REINFORCING TELEPHONES; Charles Newman, Elizabeth, N. J. App. filed June 15, 1906. In a telephonic relay, a vibratory member arranged to vary the resistance of a repeating-circuit, means for vibrating said member, and a continuously movable cylinder in contact with said member.

850,506. ELECTRIC SWITCH; Christian J. Toerring, Philadelphia, Pa. App. filed Nov. 24, 1905. A snap switch of the type having two depressible buttons with link connections to an oscillating part which causes movement of a spring impelled follower arm when the latter is released by said part.

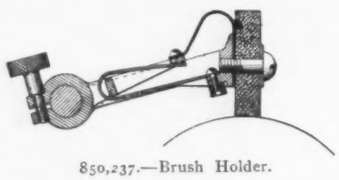
850,509. DEVICE FOR LIGHTING GAS LAMPS; Harold K. Wilson, New Bedford, Mass. App. filed March 13, 1906. Gas lighter for acetelyne lamps. A pair of metallic points are separated above the

jet so as to ignite the same by a jump spark, and circuit controlling means are provided by which any desired lamps of a group may be lighted.

850,511. TRAIN-SIGNALING SYSTEM; James S. Anderson, Ames, Neb. App. filed May 29, 1906. A device by which the accidental breaking of a train or separation of any of the cars will be instantly notified to the engineer. Has mechanical levers on the cars which hold one another in a relation to separate the circuit closing contacts when the cars are connected.

850,558. ATTACHMENT FOR TELEPHONES; Mortimer H. Black, Pittsburg, Pa. App. filed March 6, 1907. The combination with the transmitter and receiver of the telephone of a yoke pivotally supported by said transmitter, a rod adjustably supported by said yoke, a support adjustably carried by said rod, a resilient clasp adapted to embrace said receiver, and means for attaching said yoke to said transmitter.

850,570. HEADLIGHT FOR VEHICLES; Frederick G. Frankenberg, Chicago, Ill. App. filed Sept. 18, 1905. A post mounted on the dash of a motor vehicle carries an electric lamp and a dynamo. The



850,237.—Brush Holder.

dynamo is driven by a bevel gear connection with a rod running vertically through the post and having a frictional driving connection with the engine fly wheel.

850,604. SWITCH OPERATING DEVICE; Elton J. Rice, Spokane, Wash. App. filed Jan. 25, 1907. The patentee has swinging arms depending from his car which carry small electromagnets. The idea is to swing these electromagnets to one side or the other relatively of the track rail so that they will attract a switch point in passing and move it to the right position, assuming that it is not properly placed.

850,618. ELEVATOR SIGNALING APPARATUS; John D. Browne, New York, N. Y. App. filed June 30, 1906. Relates to detail of signaling system for elevators where there are a number of cars and in which certain signals are displayed for the cars going up, and other specific signals displayed for the cars going down.

850,625. APPARATUS FOR THREADING OR LAYING ELECTRIC CONDUCTORS IN CONDUITS OR PIPES; Thomas J. Cope, Philadelphia, Pa. App. filed June 11, 1906. A mechanism adapted to be inserted in a conduit pipe and which has ropes attached thereto by the manipulation of which the mechanism is caused to creep or walk through the conduit dragging the cable behind it.

830,630. ALTERNATING CURRENT MOTOR CONTROLLING APPARATUS; William N. Dickinson, Jr., Brooklyn, N. Y. App. filed July 20, 1905. A system for controlling alternating-current motors designed to reduce the chattering of the parts due to the alternating current to a minimum. It is applied mainly to elevator systems.

850,633. PROTECTIVE DEVICE FOR FRAGILE VESSELS; Samuel Ferguson, Schenectady, N. Y. App. filed Nov. 7, 1904. In order to protect glass tubes from the water hammer effect of the mercury contained therein, patentee provides a perforated metallic diaphragm in each leg or branch of the tube in the path of the mercury.

850,664. DYNAMO-ELECTRIC MACHINE; Campbell Macmillan, Schenectady, N. Y. App. filed May 25, 1906. Mechanical construction of an alternating current uni-polar machine.

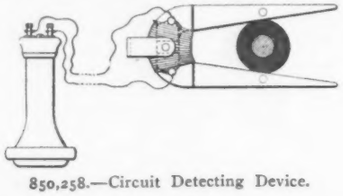
850,681. FIRE AND TEMPERATURE ALARM OR INDICATOR; George L. Smith, Aberdeen, Scotland. App. filed July 23, 1906. Relates to fire alarm adapted to operate through a rise of temperature anywhere through a considerable area. Has a tube extending throughout the area and which is filled with fluid, the undue expansion of which impels a diaphragm into a relation to close an alarm circuit.

850,687. METER; William Stanley, Great Barrington, Mass. App. filed Nov. 10, 1904. The revoluble element of the meter is journalled in a horizontal plane while the registering devices are in the usual vertical plane and are connected with the revoluble element by a 45° shaft having friction gears or cones. The registering mechanism is, however, propelled by a separate spring and electromagnet.

850,691. ELECTRICAL INDICATOR; Jesse Summers and John J. Berry, Indianapolis, Ind. App. filed April 5, 1906. An indicator of the type adapted to indicate the location of a fire by presenting a number on a counter or numbering attachment. The wheels are stepped around by an intermittently operating device which is actuated in the manner of an ordinary messenger call.

850,694. AUTOMATIC STOP FOR ELECTRIC HOISTING APPARATUS; Herbert S. Vanentine, Stamford, Conn. App. filed Jan. 10, 1907. A nut moves longitudinally on a threaded shaft under the influence of the rotation thereof and at each end engages a form of clutch which operates the motor controller.

850,714. TRANSFORMER; Claxton E. Allen and Sven R. Bergman, Lynn, Mass. App. filed April 24, 1906. The transformer is made of



850,258.—Circuit Detecting Device.

E-shaped punchings which are assembled in the form of a cross with certain other U-shaped punchings or laminæ.

850,733. BLOCK SYSTEM; Fred B. Corey, Schenectady, N. Y. App. filed Oct. 20, 1905. Block system for single track roads operating on the "staff" system. Is designed to provide a staff system adapted to suburban trolley roads where cars pass in both directions in groups and where automatic devices dispensing with attendants are required.

850,753. PRODUCING A METALLIC COATING ON A NON-VITREOUS SURFACE; Siegmund Heller and Carl Baumgartl, Teplitz, Austria-Hungary. App. filed Aug. 5, 1905. A process for producing a metallic coating upon a non-vitreous surface, consisting in fusing upon such surface a metallic composition containing gilt-enamel tombac, and plating this fused coating by electro-deposition.

850,766. ELECTRIC SIGNAL; Emile Lionais and William T. Sutton, Montreal, Quebec, Can. App. filed May 5, 1906. Instead of making the bell operating magnet the relay for its own control, patentee has a separate relay or vibrator in the circuit of the bell magnet.

850,788. SECONDARY-BATTERY PLATE AND METHOD OF MAKING SAME; Louis N. J. Roselle, Paris, France. App. filed Feb. 13, 1905. A method for manufacturing plates for secondary batteries, which consists in casting a core of active material, and casting about said core a grid provided with ramifications, said grid being provided between said ramifications with a comparatively thin film of metal, allowing the entire mass to cool, and finally removing said thin film of metal.

850,796. TROLLEY STAND AND POLE; George Q. Seaman, New York, N. Y. App. filed March 26, 1906. The trolley pole has link connections by which it is impelled upward by a spring through an intermediate detent, but in case of sudden upward movement the detent is released to permit the pole to drop.

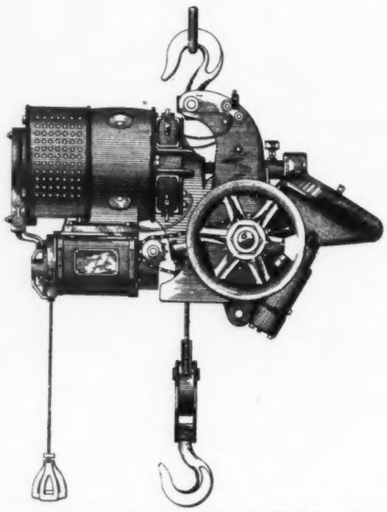
850,797. CONDUIT TRAVELER; Lewis D. Shaffer, Paint Borough, Pa. App. filed Nov. 25, 1905. Mechanism adapted to creep through a conduit by manipulating suitable cords attached thereto. Has pairs of gripping devices which alternately act to clamp themselves to the walls of the conduit pipe.

850,798. LINE CARRIER; Lewis D. Shaffer, Paint Borough, Pa. App. filed Nov. 25, 1905. Designed for use in stringing wires after the first has been strung, as well as carrying wires, lines and the like across an intervening space having a wire for supporting the device.

850,823. ANODE FOR ELECTROPLATING-CELLS; George M. Elliott, Belvidere, Ill. App. filed May 7, 1906. An anode for electroplating-cells, comprising a series of slightly-tapering teeth or columns, a severable transverse bar connecting said teeth at one end, all of said parts being integral and composed of a pire metal to be deposited on the cathode or article to be plated.

850,825. ADJUSTING MEANS FOR INTERLOCKING CONDUITS; John L. Fay, St. Louis, Mo. App. filed Sept. 16, 1905. The vitreous blocks which compose the conduit are made in sections assembled side by side and end to end in lap-jointed relation so as to be water-tight when enclosed in a surrounding bed of concrete.

850,836. CUT OUT BLOCK FOR CONNECTING FUSE IN CIRCUIT; Harry H. Hornsby, Chicago, Ill., and Edward W. Anger, Jr.,



850,694.—Automatic Stop for Electric Hoisting Apparatus.

Adrian, Mich. App. filed Dec. 10, 1903. The ends of a fuse cartridge are specially notched so that only a predetermined fuse can be assembled in a certain circuit.

850,837. SELECTIVE CALL APPARATUS; John A. Hulit, Topeka, Kan. App. filed July 13, 1905. The combination of the switch-shifting ratchet, a propelling device and a holding pawl therefor, and a compound balance-bar adapted to move slowly by the force of gravity in both directions.

850,853. FIRE ALARM APPARATUS; George W. Smith, Baltimore, Md. App. filed Dec. 8, 1906. Relates to details of the local alarm bell of a fire alarm box by which it is rung whenever the door is opened to turn in the alarm proper.

850,858. EMERGENCY TELEGRAPH; Murray C. Tunison, Los Angeles, Cal. App. filed July 27, 1905. A tablet having grooves with inset segments or contacts and through which a stylus is moved to transmit a signal in case a person who does not understand telegraphy has to transmit a message in some emergency.

850,863. TRANSFORMER; William J. Wooldridge, Schenectady, N. Y. App. filed June 8, 1906. Designed to obtain a more effective use of the conductive material of the transformer by so arranging it that portions from which the heat is more readily dissipated carry more current per unit of cross sectional area than the other portions.

850,867. BATTERY OF ELECTROLYTIC CELLS; Robert H. F. Finlay, Belfast, Ireland. App. filed Feb. 12, 1907. In an electrolytic cell, an anode comprising a frame, two series of carbons, one supported in each side of said frame, and copper bands connecting the outer ends of said carbons.

850,870. ELECTRICAL SWITCH; Ray H. Manson, Elyria, O. App. filed May 9, 1904. Telephone switch hook detachably secured to its pivot or fulcrum and having a yielding pressure device normally maintaining the hook in assembled relation thereon.

850,872. MOTOR CONTROLLER; Adolph Pedersen, Cleveland, O. App. filed Aug. 16, 1905. Has means controlled by the magnetic flux of the motor for moving the circuit closing arm thereof over the resistance contacts.

850,881. COMPOSITE METAL; Llewellyn Park, Orange, N. J. App. filed Jan. 20, 1906. A material for use in storage batteries composed of cobalt and nickel each in the form of a substantially integral sponge-like structure intimately engaging together to form a continuous solid mass.

850,886. TELEPHONE ATTACHMENT; Delzon G. Hobby, Albion, N. Y. App. filed May 14, 1906. A device for supporting a telephone receiver in proper proximity to the ear when the device is being used. At other times the receiver is moved out of the way by a connection from the telephone switch hook.